PB-215 097

POTOMAC RIVER BASIN. REPORT ON WATER POLLUTION CONTROL

Public Health Service
New York, New York

1951

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Water Pollution Series No. 28

PB 215 097

For Clean Water — "One River, One Plan"

Report on Water Pollution Control

POTOMAC RIVER BASIN

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FEDERAL SECURITY AGENCY
PUBLIC HEALTH SERVICE
North Atlantic Drainage Basins

101

REPORT ON WATER POLLUTION CONTROL

POTOMAC RIVER BASIN

1951

Prepared by

FEDERAL SECURITY AGENCY
Public Health Service
Division of Water Pollution Control
North Atlantic Drainage Basins Office
42 Broadway, New York 4, N.Y.

On the basis of information supplied by the following agencies:

Maryland Water Pollution Control Commission
Pennsylvania Sanitary Water Board
Virginia State Water Control Board
West Virginia Water Commission
District of Columbia Health Department
Interstate Commission on the Potomac River Basin

FOREWORD

This Report, based on information supplied by the several State water pollution control agencies and the Interstate Commission on the Potomac River Basin presents a reasonably adequate picture of the current (July 1950) status of water pollution in the Potomac River Basin, and is a step in the furtherance of comprehensive programs for water pollution control in the Basin.

The major portion of this report was compiled from data on file in the offices of the Interstate Commission on the Potomac River Basin and the official water pollution control agencies of the States. There are some gaps in the data as additional extensive field surveys by the Agencies to obtain complete information for the Report were not possible because of the limited personnel available and time that would be required.

Attention is specifically directed to the lists of needed projects (Table I). These lists are based on information readily available pending the completion of additional field surveys and investigations by the appropriate State water pollution control agencies, but are believed to contain most of the significant sources of pollution. The omission therefrom of any specific municipality, institution, or industry does not necessarily mean that a project is not needed and that notification to this effect will not be issued by the respective State water pollution control agency.

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AUTHORITY FOR REPORT

This report is authorized in the Water Pollution Control Act, Public Law 845, 80th Congress, approved June 30, 1948. Specific attention is directed to the Congressional policy stated in that Act to "recognize, preserve and protect the primary responsibilities and rights of the States in controlling water pollution". Section 2 of the Act directs that the Surgeon General of the Public Health Service "shall, after careful investigation, and in cooperation with other Federal agencies, with State water pollution agencies and interstate agencies, and with the municipalities and industries involved, prepare or adopt comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof and improving the sanitary condition of surface and underground waters. In the development of such comprehensive programs due regard shall be given to the improvements which are necessary to conserve such waters for public water supplies, propagation of fish and aquatic life, recreational purposes, and agricultural, industrial, and other legitimate uses. For the purpose of this subsection the Surgeon General is authorized to make joint investigations with any such agencies of the condition of any waters in any State or States, and of the discharges of any sewage, industrial wastes, or substance which may deleteriously affect such waters."

ACKNOWLEDGEMENTS

The Public Health Service wishes to express particular appreciation to the following agencies for supplying the information upon which this Report is based, reviewing the preliminary draft and submitting helpful comments.

Maryland Water Pollution Control Commission

Pennsylvania Sanitary Water Board

Virginia State Water Control Board

West Virginia Water Commission

District of Columbia Health Department

Interstate Commission on the Potomac River Basin

The Federal agencies from which assistance was obtained include: The Corps of Engineers, Department of the Army; Fish and Wildlife Service and Geological Survey, Department of the Interior; Bureau of the Census, Department of Commerce; and Soil Conservation Service, Department of Agriculture.

SUMMARY

From its headwaters on the eastern slope of the Appalachian Mountains, the Potomac River flows generally in a southeasterly direction some 400 miles to Chesapeake Bay. The upper river runs through the mountainous terrain of the Alleghenies and the rolling hills of the Piedmont Plateau, reaching tidal elevation just below Great Falls near the District of Columbia line. The River drains an area of approximately 14,700 square miles in Maryland, Virginia, West Virginia, Pennsylvania, and the District of Columbia.

There are 13 major cities and over 120 smaller communities scattered throughout the Potomac River Basin. The largest is the Nation's Capital which, in its metropolitan area, includes over half of the Basin's population of 2,200,000.

The mountainous section around the headwaters of the Potomac is sparsely settled and many of the inhabitants, formerly employed in lumbering and mining, now live largely by farming. In central Maryland and the Shenandoah Valley the lands are fertile and highly cultivated. East of the Blue Ridge and south of Washington there are opportunities for additional farming operations, with good markets at Baltimore and Washington.

The Basin has well-developed recreation areas, including portions of Shenandoah National Park, Monongahela National Forest, George Washington National Forest, and many other Federal and State parks.

The Potomac River is navigable for a distance of 117 miles, from the Chesapeake Bay to Georgetown in the District of Columbia, where tidal action ceases. Shipping is principally to Washington and Alexandria. The River and its tributaries above Washington provide fishing, boating and camp sites. The lower Potomac is known as an excellent waterfowl feeding ground and muskrat producing area, and is noted for duck shooting. It contains commercial and game fishing areas and oyster beds, and is used widely for boating activities. Suitable areas for bathing purposes are confined to the lower sections.

Among the industrial plants in the basin are textile mills, pulp and paper plants, coke and gas works, tanneries, chemical industries and others. Cumberland is the leading manufacturing center. Coal is the important mineral source.

The water in the Potomac River Basin is used principally for domestic, industrial and recreational purposes. A total of 184 developed municipal and industrial water supplies are recorded including both surface and ground water sources. Of

this number, 68 are surface water supplies, about half municipal and half industrial. Municipal surface water supplies range from 20,000 to 220,000,000 gallons daily. Total industrial and domestic water usage from surface streams is about 1.5 billion gallons daily. Of this amount approximately 267,000,000 gallons, or 18 per cent, is municipal consumption for about 1,500,000 people. The remaining 1.2 billion gallons daily are for industrial uses, two-thirds being used for the enormous cooling water requirements of power companies.

The Potomac River and its tributaries receive the discharges from 136 municipal sewer systems which serve a population of approximately 1,597,000. Industrial wastes are discharged directly to the streams from 102 establishments. Of these 72% are primarily organic in character. Twenty-seven establishments discharge inorganic wastes. The type discharged from five plants is undetermined.

The two major areas of pollution are along the North Branch between Luke and Cumberland, caused by the discharge of wastes from industries, domestic sewage and acid mine drainage; and the Potomac River and the Anacostia River in the Washington Metropolitan Area, caused by the discharge of sewage and industrial wastes. More than two-thirds of the total municipal pollution in the entire Basin is contributed by Washington, D.C., and its environs, including Alexandria and Arlington County, Virginia.

Acid mine drainage continues to be one of the major sources of pollution in the upper portion of the Basin. Soil erosion has been particularly damaging in substantial portions of the area. This is being reduced in 20 soil conservation districts containing 59,400 farms covering 10,000,000 acres. Farm conservation plans have been prepared for about two million acres and approximately half of the recommended work has been completed.

A population of approximately 1,400,000 or about 87% of the estimated sewered population is now served by 87 sewage treatment plants in the Potomac River Basin. About 70% of the sewered population is served by 34 primary treatment plants and about 17% is served by 53 secondary treatment plants. There are 50 municipal sewer systems with no treatment, serving about 13% of the sewered population.

Industrial waste treatment facilities are provided at 53 of the 102 industrial establishments, which are sources of pollution within the Potomac River Basin. No waste treatment facilities are provided for 32 plants and the situation at the remaining 17 plants, is undetermined. Approximately 53% of the establishments are related to food and kindred products, of which about one-half have waste treatment facilities. Sand and

clay mining activities which produce inorganic wastes comprise about 12% of the industrial waste discharges, and two-thirds of these have treatment facilities.

Approximately 53% of the existing municipal sewage treatment plants are of adequate design and are operated in a satisfactory manner; 27% are unsatisfactory as to design and operation; and 20% are undetermined.

Industrial waste treatment facilities are satisfactory in approximately 38% of the establishments, unsatisfactory in 34%, and undetermined in the remaining 28%.

A few municipal sewage treatment plants were constructed during the 1920's, with real progress during the 1930's aided by Federal work programs. Relatively few plants were constructed during 1946 to 1949 inclusive. Six treatment plants serving a population of about 36,000 were completed, the major installation being the sewage treatment works of Winchester, Virginia.

New or improved sewage treatment plants are needed for 62 municipalities to serve a population of approximately 1,400,000, including improvements to 19 existing plants which serve 74% of the sewered population, and erection of 43 new plants to serve 13% of the sewered population. Currently, 54 municipalities with 10% of the sewered population have adequate sewage treatment facilities.

Fifty industrial establishments, about 50% of the reported sources of industrial wastes, require improved or new waste treatment facilities. Information is needed to determine the waste treatment status at 35 establishments. Waste treatment facilities are adequate for only 17 establishments, or 17% of the reported sources of industrial wastes.

The estimated cost for construction of sewage and industrial waste treatment plants to abate stream pollution in the Potomac River Basin ranges from $40,000,000 to $50,000,000. Current progress is reflected less by actual construction than by activity preliminary to construction. Plans have been prepared by 12 municipalities and are under way for an additional thirteen. An $11,000,000 program is under way for the District of Columbia which is not scheduled for completion before 1957.

Among the most encouraging aspects of current progress have been the recent strengthening of State laws governing pollution, the aggressive programs of the State water pollution control agencies, the cooperative attitudes displayed by industry, and the energetic programs of the Interstate Commission on the Potomac River Basin. Reinforced by public support of the conservation groups, they constitute potent forces determined to attain clean streams in the Potomac Basin.

CONCLUSIONS

1. Information concerning most of the principal sources of pollution in the Potomac River Basin is sufficient to determine needed corrective measures without awaiting the results of further surveys and investigations.

2. Although considerable information is available, all sources of pollution are not known and analytical data on many known sources of pollution are incomplete. More stream water quality data and information on water uses are needed.

3. Acid mine drainage from the coal fields continues as a major problem in some headwater streams, and limits beneficial uses of the affected streams.

4. Silt resulting from soil erosion is one of the most damaging forms of pollution affecting many water uses over wide areas.

5. Financing the costs of construction and operation of pollution control works, while a major problem, is not insurmountable as evidenced by past and current progress. Postponement of pollution abatement action predicated on the anticipation of grants-in-aid will only defer stream improvement which is now long overdue.

6. Educational programs designed to acquaint the populace with the pollutional conditions and measures required for correction are an essential item in pollution control and must be continued incessantly if success is to be attained. More concentration in this field is needed.

7. Stream pollution abatement has not kept pace with population and industrial growth and the problem threatens to become more serious unless the programs of control agencies are accelerated.

RECOMMENDATIONS

It is recommended that:

1. Positive action be taken by the responsible municipalities and industries, in accordance with the requirements of their respective States, to provide for the pollution abatement projects appearing on the project list, shown on Table I.

2. Comprehensive stream investigations be undertaken throughout the Basin to provide more complete data on sources of pollution, stream water quality and water uses.

3. Research be expanded to learn the causes of mine acid formation and to find a practical solution to the problem.

4. Organizations, such as the Monocacy Valley Council, be encouraged and fostered in other areas as a means of developing local participation in resource conservation measures, including water and soil.

5. Municipalities and industries alike recognize their duty and responsibility, in accordance with the requirements of their respective States, to preserve our water resources and initiate measures to provide the funds needed to finance pollution control projects.

6. Public information programs be expanded and continued through every available means such as press, radio, motion pictures, television, civic clubs, pamphlets, posters, and direct mail.

7. Increased funds, personnel and facilities be provided by the States to their respective water pollution control agencies and to the Interstate Commission on the Potomac River Basin commensurate with their duties and responsibilities.

REPORT ON WATER POLLUTION CONTROL

POTOMAC RIVER BASIN

HISTORICAL BACKGROUND

The upper and lower portions of the Potomac River Valley were settled about 1730. The River has been a principal factor in the development of the Valley, providing from early times a means of transportation and communication. From 1804 until 1842 coal mined in the northwestern section of the basin was stored in piles along the bank of the river and sent downstream on flat-boats during the spring run-off. From 1850 until 1924 coal, flour, grain, lumber, building stone and other commodities were shipped on the Chesapeake and Ohio Canal, which has since ceased operation because of decline in patronage.

From its early outpost settlements the Potomac Valley developed in an orderly manner until the Civil War with its four years of destruction and devastation. With peace, in 1865, came a resumption of the growth and prosperity so that today the Potomac River Basin stands as one of the most important in the country.

PHYSICAL DESCRIPTION

Geography

The Potomac River is formed at the confluence of its North and South Branches about 20 miles southeast of Cumberland, Maryland. Flowing southeasterly for 285 miles, it becomes tidal just above Washington and discharges into the Chesapeake Bay 117 miles below Washington. The river is bounded by Maryland and the District of Columbia on the north side and Virginia and West Virginia on the south. The total fall of the river from the confluence of the North and South branches to tidewater is 520 feet. (See Appendix A.)

The Potomac Basin is shaped roughly like an "inverted U", with Chesapeake Bay at the foot of the right leg. The basin is bounded on the north by the Juniata and lower Susquehanna Basins, on the west by the Ohio River Basin, on the south by the James River and the Lower Chesapeake Bay Basin, and on the east by the Upper Chesapeake Bay Basin.

The drainage basin includes an area of 14,670 square miles in West Virginia, Pennsylvania, Virginia, Maryland, and the District of Columbia. Through this area flow the North Branch, South Branch, Cacapon River, Conococheague Creek, Shenandoah River, Monocacy River, Anacostia River, and many small streams

and creeks. (See Appendix B.) All or parts of 17 Counties in Virginia, 8 Counties in West Virginia, 9 Counties in Maryland, and 5 Counties in Pennsylvania, and the District of Columbia lie within the Basin with an area in square miles for each State as follows:

Virginia	5880	square miles
West Virginia	3490	" "
Maryland	3720	" "
Pennsylvania	1511	" "
District of Columbia	69	" "
TOTAL:-	14,670	square miles

Topography

The Basin lies within a portion of the Atlantic Slope from the Allegheny Mountains to Chesapeake Bay consisting of five physiographic regions: the Allegheny Plateau, the Valley and Ridge Province, the Blue Ridge Province, the Piedmont Plateau and the Coastal Plain.

The Allegheny Plateau and the Blue Ridge Province consist of two parallel rugged mountain ranges with altitudes ranging from 1,200 to 4,000 feet or more. In this area are the headwaters of many of the fast-flowing, precipitous streams tributary to the Potomac.

Between the Allegheny Plateau and the Blue Ridge Province lies the Valley and Ridge Province with a number of parallel valleys separated by lower ridges varying in height from 250 to 2,000 feet. Streams in the western two-thirds of the area flow through rugged terrain and have comparatively steep slopes, rocky beds and precipitously-sided valleys. The eastern one-third of the Valley and Ridge Province covering the basins of the Shenandoah River and Conococheague Creek is known as the Shenandoah Valley.

The Piedmont Plateau, located east of the Blue Ridge Mountains, has a rolling configuration with elevations ranging from 200 to 1,000 feet. It is traversed by highlands which are cut by many small valleys.

Below the eastern escarpment of the Piedmont Plateau the Basin lies on the Coastal Plain, a relatively flat region varying in elevation from sea level to 250 feet above. In this region the River is tidal.

Climate

The climate of the Basin is temperate, with warm summers and rigorous but generally not severe winters. Sub-zero temperatures occur annually west of the Blue Ridge Mountains and occasionally over the entire Basin. East of the Blue Ridge extremes are seldom encountered due to modification by winds from the Atlantic Ocean. Temperatures of 30 below zero at Bayard, West Virginia, and 112 above at Martinsburg, West Virginia, have been recorded. The average annual temperature for the basin is about 54 degrees. Ice has formed on most streams for short periods. However, ice coverage ordinarily is not sufficiently general to interfere seriously with aeration. During severe winters ice coverage probably interferes with normal biological activity and causes pollution to be carried much farther than during open water seasons.

Precipitation

Precipitation in the basin is moderate. The mean precipitation is about 38 inches per year, with an annual range from 27 to 50 inches. The Allegheny Plateau has the most rainfall, the Blue Ridge and Coastal Plain more than average, and the Valley and Ridge Provinces the least. The mean average snowfall in the basin varies from 5 inches on the Coastal Plain to 30 inches in the Allegheny Plateau.

During the year there are approximately 110 rainy days. Approximately 55% of the rainfall occurs between April and September. July and August are usually the wettest months of the year with an average precipitation of about 4 1/3 inches, while November is the driest with an average of 2 1/3 inches.

Storms

Large storms have visited the Basin in the past and can be expected in the future. From consideration of past storms on the Atlantic Slope it has been concluded that a 3-day storm of 8 inches rainfall is possible throughout the area. Local storms as high as 15 inches in 3 days have been recorded.[1/]

Run-Off

The run-off from precipitation is about 35%, producing an average stream flow over the entire basin of 0.98 c.f.s. per square mile. The run-off from the various tributaries of the Potomac varies from 0.58 to 1.92 c.f.s. per square mile. The

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1/ U.S. Corps of Engineers. Potomac River and Tributaries including Occoquan Creek. 73rd Congress, 1st Session, House Document 101, p. 23, Washington, D.C.

flow at Point of Rocks, Maryland, just above Washington, has varied from a minimum of 540 to 480,000 c.f.s. The shape and character of the Potomac Basin provides conditions favorable to rapid run-off. Freshets producing high peak flows disappear rapidly. Thus, the Potomac and its tributaries may be described as flashy.

ECONOMIC DEVELOPMENT

Population

The estimated total population of the Potomac River Basin, based upon the Census of Population, Preliminary Counts, April 1, 1950, is 2,200,000 and shows an increase of 526,000 since 1940 or a gain of 31%. Since 1920 the population has increased 78%, as follows:

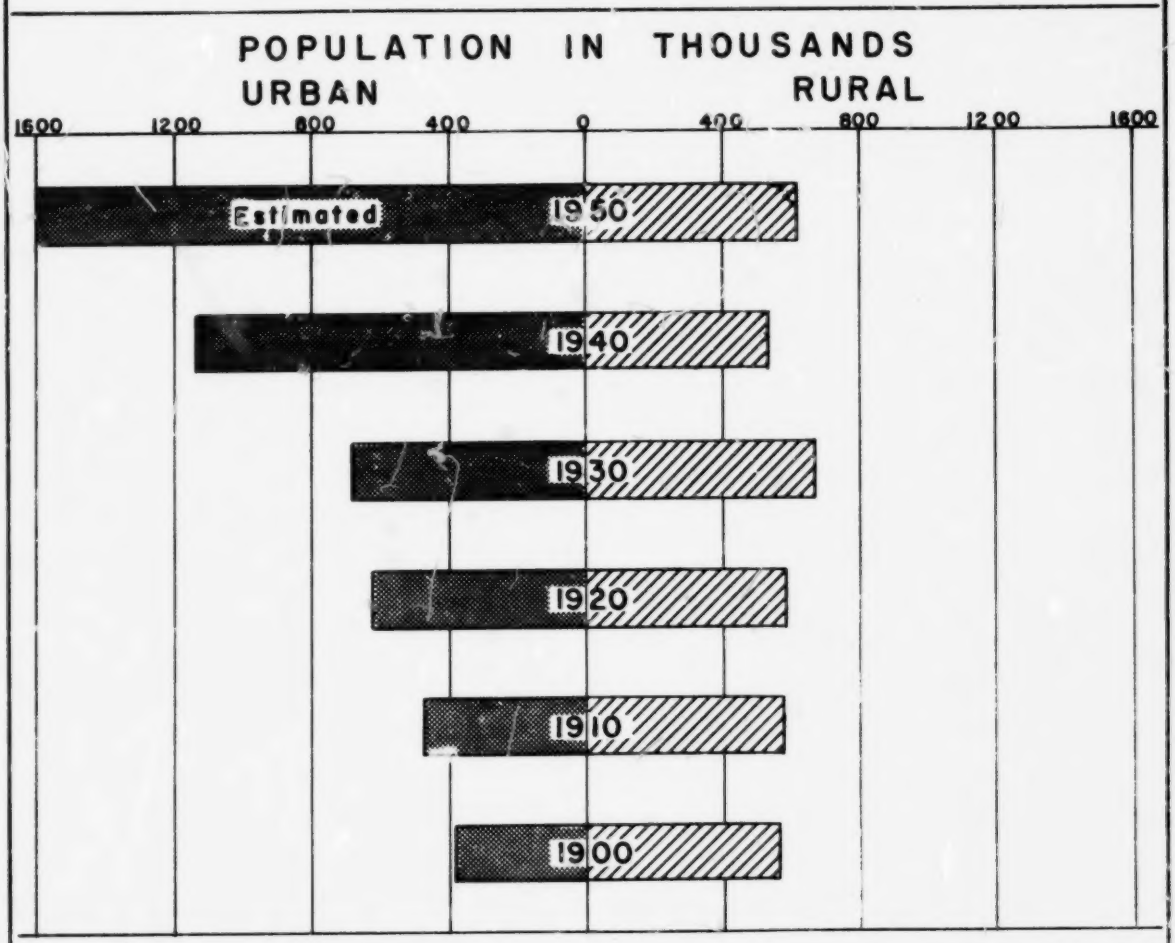
1920	1,234,000
1930	1,435,000
1940	1,674,000
1950	2,200,000

The rural population has remained fairly stable between 550,000 and 700,000 since 1900, but has varied considerably in percentage of the total population. (See Fig. 1) The rural population comprised approximately 60% of the basin population in 1900 and 26% in 1950. The Washington metropolitan area, which includes nearby communities in Montgomery and Prince Georges Counties, Maryland, and Arlington and Fairfax Counties, Virginia, has a population of 1,457,600. This area has about 66% of the basin population and has increased rapidly. Excluding the Washington metropolitan area, the 1950 rural population of 600,000 is 80% of the basin population. There are 20 cities and towns with populations over 5,000 and more than 100 with populations of 500 or more within the Basin. Population data are listed in Appendices C, D, and E.

Industry

Important industrial cities are Cumberland, Frederick and Hagerstown in Maryland; Chambersburg, Gettysburg, and Waynesboro in Pennsylvania; Alexandria, Front Royal, Harrisonburg, Staunton, Waynesboro, and Winchester in Virginia; and Martinsburg, in West Virginia. In 1947, the latest year of record, there were 2,100 manufacturing establishments, about the same as in 1929, within the Basin. These establishments employed 109,000 persons in 1947 in contrast with 67,000 in 1929. The highest industrial employment

POTOMAC RIVER BASIN
GROWTH OF POPULATION



Sources–
U.S. Department of Commerce, Bureau of the Census,
Interstate Commission on the Potomac River Basin,
Washington, D. C.

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Figure 1

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density is in the northern and the southwestern sections. Wages and salaries amounted to $258,000,000 and the value added to products by manufacture was slightly over $465,000,000 in 1947. The more important products manufactured include textiles, leather, pulp and paper, chemicals, food stuffs, rubber, metal, electrical and transportation equipment.

Mining

In 1939 there were 299 companies operating mines, quarries or preparation plants within the Basin, which employed 12,000 persons, paid wages and salaries of $12,600,000 and produced minerals, including bituminous coal, valued at $19,440,000. Approximately 2,000,000 tons of coal are produced annually, the value in 1948 being over $10,000,000. The commercial coal fields are located in Allegany and Garrett Counties, Maryland, and Mineral and Grant Counties, West Virginia. These fields have been worked since the early 19th Century. A six-year survey recently completed of the coal seams of the Georges Creek Basin and the northwestern part of the Upper Potomac Basin indicates total reserves in these seams of more than 600 million tons of which only 50 - 60% can be recovered under present mining practices but 80% with modern mechanical equipment. Other mineral products in the basin are limestone, granite, basalt, sandstone, marble, sand and gravel, glass sand and fine clay.

While recent surveys of the coal fields in the northwestern section of the Basin indicate adequate reserves are available, there is little prospect of any great increase in production, because the mining of the thinner veins is costly. This situation will probably present a problem along the North Branch and in the Cumberland region where farming is limited. For continued economic development reliance must be placed on expansion of industry. To induce industry to expand or to locate in this area, it will be necessary to improve the streams so that sufficient clean water is available for industrial processes. The Savage River Dam, now under construction, will improve this situation.

Lumber Operations

There are approximately 1,000 lumber mills within the Basin, an increase of 100% since 1941, many of them being small operations. Production increased from 130,000 M. Ft.B.M. to 173,000 M. Ft.B.M. from 1941 to 1947, respectively.

Agriculture

The principal farming areas are in central Maryland and the Shenandoah Valley. The principal products are forage crops, grains, fruit, livestock, and dairy products. The agricultural area comprises about 6,000,000 acres or 65% of the Basin area,

and in 1945 contained 53,000 farms which is less than a 2% increase in number since 1940. The value of all farm products in 1945 was $156,000,000, compared with $92,000,000 in 1929 and $68,000,000 in 1939.

The Shenandoah Valley, while predominantly agricultural and rich in scenic and other natural features is expanding in its industrial facilities as evidenced by the growth since 1940 in the manufacture of textiles and biological products and the establishment of a number of small industries. An important factor for this expansion is the availability of a water supply satisfactory for industrial uses.

Soil Erosion

Soil erosion is a serious problem to agriculture, also creating a stream pollution problem in the Basin. Moderate erosion, with occasional or frequent gullying, occurs in a major portion of the Basin. Severe sheet erosion is evident in Morgan, Berkeley, and Hardy Counties, West Virginia; and Frederick County, Maryland. It has been estimated that erosion contributes an average annual mud load of 1,700,000 tons to the Potomac River at Washington.

Forests

More than half of the Potomac Basin is forested, particularly the western portion. In the mountainous regions are located portions of Shenandoah National Park, and Monongahela and George Washington National Forest. These public areas cover approximately 900,000 acres of the Basin in Virginia and West Virginia. In addition, there are State forest areas comprising 67,000 acres in Pennsylvania and 63,000 acres in Maryland.

In general, all of the forest areas consist of cut-over timber including yellow pine, poplar, oak, gum, maple, sycamore, and cypress.

Parks

Most parks have recreational facilities for camping, picnicking, hiking, swimming, and fishing for public use. These lands in public parks and recreational areas in the Basin amount to over 62,500 acres. (See Appendix F.) Shenandoah National Park, which extends 65 miles along the crest of the Blue Ridge Mountains from Front Royal, Virginia to the vicinity of Waynesboro, Virginia, attracted a million visitors to its famous Skyline Drive during 1949. Some of the other better known Federal parks and recreational areas are Gettysburg National Military Park, Catoctin Recreational Area, and George Washington Memorial Parkway.

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Transportation

Transportation is an important factor in industrial expansion and suburban development, extending the pollution control problem to areas previously unaffected. Transportation facilities also provide the urban people easy accessibility to recreational areas in the parks and upstream areas throughout the Potomac River Basin.

The Potomac River Basin is served by eight major railroad lines; the Baltimore & Ohio, Pennsylvania, Western Maryland, Chesapeake & Ohio, Norfold & Western, Atlantic Coast Line, the Southern Railroad, and the Richmond, Fredericksburg & Potomac. The first four serve the largest portion of the Basin.

Numerous good highways and interconnecting highways traverse the watershed, the principal ones being U.S. Nos. 1, 11, 40 and 50.

Major airlines such as Eastern, American, Capital, United, Northwest Orient, and Trans World serve Washington. All American Airlines gives service to Cumberland and Hagerstown, Maryland. There are several municipal airfields in the Basin not ordinarily used for scheduled flights.

The Potomac River is navigable as far upstream as Georgetown in the District of Columbia. There are harbor facilities at Washington, D.C. and at Alexandria, Virginia.

USES OF WATER RESOURCES

Streams

The main streams in the Potomac River Basin, their drainage areas and profiles, are shown on Map No. 1. A detailed description of these streams appears in Appendix G.

Water Supplies

Water for domestic and industrial use in the basin is taken from both surface and underground sources. Nearly 100 surface supplies are taken from the Potomac and its tributaries. Underground supplies are taken from springs and wells of various types.

In general, the water from the streams in the Alleghany, Blue Ridge, Piedmont and western part of the Valley and Ridge areas is soft and suitable for both domestic and industrial uses while that from the Shenandoah Valley is generally hard due to the predominance of limestone deposits in that area. The entire valley of the Shenandoah is honeycombed with limestone caverns, aquifers or solution channels and galleries. Such formations are particularly susceptible to pollution. The water in the

Potomac River is generally fresh below Washington to Quantico, Virginia, where, due to tidal action, it increases in salinity.

A total of 184 developed water supplies for municipal and industrial use are recorded in the Basin taken from surface streams, springs and drilled wells. Of this number 87 are surface water supplies as shown in Appendix H.

The average water consumption for industrial and domestic purposes is approximately 1,408,000,000 g.p.d. During the critical periods of low flow, the water of the Potomac River and its tributaries is re-used several times as it flows downstream. Thus, the sewage, industrial wastes and cooling waters from one community or industry must be used in whole or in part as the drinking water or as industrial water supply by communities or industries downstream. This condition has necessitated large expenditures for water treatment facilities by both municipal and industrial users, in order to procure the necessary water quality.

Navigation

The Potomac River is navigable from Georgetown in the District of Columbia, where tidal action ceases, to Chesapeake Bay. Varied cargoes of agricultural, animal, seafood, mineral and lumber products, fuels and oils, and miscellaneous manufacturing products are brought in, mainly to Washington and Alexandria. Cargoes of steamers, motor vessels, barges and scows amounting to 1,878,000 tons were handled in 1946, and 1,640,851 passengers, mostly local excursionists, were carried.

The Potomac has many navigable estuaries up to Washington. Recreational use of the river is afforded to the general public in many forms. A number of excursion steamers make trips to Mt. Vernon and other localities along the Potomac and Chesapeake Bay. Private craft are used on the river and many piers and docking facilities are available. Boating is increasing tremendously. The river also enhances the recreational value of the Memorial Parkway from Washington, D.C. to Mount Vernon, Virginia, and parks further south.

Commercial Fishing

Commercial fishing and shellfishing areas are found in lower portions of the river below Washington and in the many tidal estuaries.

The main types of fish taken are herring, croaker, shad, sea trout, and striped bass. In addition, shellfish (mainly oysters) and some crabs are taken. This industry is located in the lower river Counties of Charles and St. Mary's in Maryland, and in the Counties of Westmoreland, Northumberland, and Prince William in Virginia.

The annual fish and oyster catches amounted to $1,610,695 and $1,429,055, respectively, in 1945. The 1945 catch of shad and alewife in the Potomac River amounted to about $96,000 and $110,000, respectively.

Game Fish and Hunting

The upper Potomac and its tributaries have been noted far and wide for their excellent game fish, including small mouth bass, brown, brook and rainbow trout, yellow perch, crappie, and blue gills. Game and pan fish are produced in great quantities. The wildlife conservation agencies are continously restocking the heavily fished streams, especially with trout, for the benefit of the growing numbers of fishermen. Although some streams have been rendered useless for game fishing by pollution, the sport continues to increase, especially in Virginia and West Virginia.

Excellent waterfowl feeding grounds and muskrat producing areas are found in the lower Potomac and many of its tidal estuaries. This area has been noted for years for its excellent duck shooting.

Water Power

Many dam and reservoir sites suitable for the development of hydro-electric power 1/ are available in the Basin. Any plan that may be developed must take into consideration the effect such installation may have on other important uses, particularly water supply, game fishing, and waste disposal.

There are a number of small hydro-electric projects with a total installed capacity of 17,000 kilowatts. No plants exceed 3,000 kilowatts capacity, and most are considerably smaller. Most installations are owned by adjacent municipalities or power companies serving local areas. These installations, being essentially run-of-stream in character, are maintained usually as sources of peak-load power in conjunction with steam power plant installations.

Recreation

The Potomac River Basin offers a variety of forms of recreation to its inhabitants and visitors. More leisure time for many people and ease of travel to practically all parts of the Basin, have greatly increased the public use and enjoyment of the many historic shrines and scenic mountains, parks, and rivers within the Basin.

Thousands of people visit the Nation's Capital every year and participate in the opportunities for recreation provided in the area.

1/ House Document 622, 79th Congress, 2nd Session

Many of the streams are widely used as summer camping sites, for boating and for fishing. Facilities for similar concentrated recreation, such as picnic areas and trails for hiking, are provided in the state and national parks. The state parks contain some of the best fishing streams open to the public. Hunting is generally permitted in state forests but not in state parks.

The lower portion of the Basin, below Washington, is noted for its excellent duck shooting and is used extensively for boating.

Tourists attracted to the region by its recreational opportunities constitute an important source of revenue to business enterprises in the area.

Surface waters of the Basin must be preserved and improved if they are to provide maximum recreational use.

POLLUTION CONTRIBUTED TO WATER RESOURCES

The quality of the water in the Potomac River and its tributaries is being impaired by the discharge of sewage, industrial wastes, and acid mine drainage into the streams, and by soil erosion.

A summary of the data submitted by the water pollution control agencies within the Basin shows the existence of 238 sources of pollution, consisting of discharges from 136 municipal or institutional sources, and 102 separate discharges of industrial wastes. The pollution load discharged from 110 of the municipal or institutional sources and 19 industrial establishments, for which data were readily available, has a population equivalent of about 1,541,000 - approximately the total sewered population. This does not include the pollution discharged from 26 municipal or institutional sources, and 54 industrial, on which no report was received.

Data concerning sources of municipal pollution are set forth in Table A indicating that approximately 1,597,000 persons, or 72.5% of the estimated population in the Basin, are served by sewerage. The pollution from 110, or about 80% of the municipal sources, for which data are readily available, is reduced about 30% before discharge to receiving streams by the operation of sewage treatment facilities in 72 municipalities.

TABLE A

SOURCES OF POLLUTION

MUNICIPAL

Municipalities(*)	Sources of Pollution (In Number of Municipalities)	Pollution Served by Sewerage System	Amount of Pollution Discharged to Watercourse (In Terms of Equiv. No. of People(**)
Having data on pollution load discharged to watercourse	110	1,557,731	1,111,450
Having pollution data available. (Data on pollution load to watercourse incomplete or not available)	26	39,208	Not applicable
TOTAL	136	1,596,939	xxxxxxxx

(*) Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

(**) Includes industrial wastes discharged into municipal sewerage systems.

Industrial waste pollution data reported are summarized in Table B. There are 102 industrial establishments discharging polluting waste waters into the streams of the Basin. These consist of 73 which produce organic wastes, including three which also produce inorganic wastes; 27 which produce inorganic wastes, and five which produce wastes of undetermined type. Information is available for about one quarter of the establishments producing organic wastes, showing that these discharge to streams pollution with a population equivalent of approximately 430,000.

TABLE B

SOURCES OF POLLUTION

INDUSTRIAL(*)

Industries	Sources of Pollution (In Number of Plants)	Amount of Pollution Discharged to Watercourse (In Terms of Equivalent Number of People)
Producing Organic Wastes	19(a)	429,805
Producing Organic Wastes	54	Undetermined
Producing Inorganic Wastes	27	Not Applicable
Producing Wastes of Undetermined Type	5	Undetermined
TOTAL	102 (b)	xxx xxx

(a) Includes 3 plants also producing inorganic wastes
(b) Total adjusted to correct for duplication noted in (a)

(*) Industries having separate outlets and dischargine wastes directly to watercourse.

The two major areas of pollution in the watershed are on the North Branch of the Potomac between Luke and Cumberland and the Potomac River near Washington. The Anacostia, Monocacy and South Rivers and Opequon Creek are also considerably polluted.

The North Branch of the Potomac is polluted by wastes from industries, domestic sewage, and acid mine drainage. Untreated sewage from a population of approximately 67,000 persons is discharged from 13 municipalities. Industrial wastes from four of the reported sources of pollution contribute an additional population equivalent of 249,000. Thus, the combined pollution is equivalent to that from a population of 316,000. Mine drainage has been estimated to contribute approximately 172,000[1/] pounds of acid per day. Stream surveys conducted during the summers of 1946 and 1947 by the West Virginia Water Commission, and from July 1, 1947 to the present by the Interstate Commission on the Potomac River Basin, show the adverse effect of acid mine drainage down to Luke where the discharge of industrial wastes and sewage sharply reduces the dissolved oxygen content and increases the biochemical oxygen demand. A slight improvement occurs by the time the stream reaches Amcelle, Maryland, where considerable industrial waste is discharged. In the Cumberland area the oxygen is entirely depleted during most of the summer months. The stream becomes septic, creating nuisance conditions until the waters of the South Branch, a relatively pure stream, mix with those of the North Branch.

At Paw Paw, West Virginia, the Potomac River receives sewage and industrial wastes which in combination with the pollution already carried by the Potomac materially affects the stream for approximately five miles. Additional pollution is discharged at Hancock, William[illegible]t, and Brunswick, Maryland, and in addition the Potomac receives the polluted waters of Opequon Creek and the somewhat cleaner waters of Antietam Creek and the Monocacy River.

Pollution in the main stem of the Potomac is gradually reduced through natural self-purification and dilution by the inflow of some of the larger tributaries. Below Harpers Ferry conditions are not materially changed until the Washington metropolitan area is reached where sewage and industrial wastes from Washington, the Washington Suburban Sanitary District, Arlington, Alexandria, and Fairfax County, Virginia, contribute pollution having a population equivalent of 890,000. The pollution in this section cannot be assimilated satisfactorily. During low summer flows the dissolved oxygen has at times dropped below two p.p.m. with a Biochemical Oxygen Demand of four to eight p.p.m. Bad conditions prevail in the vicinity of the Washington, Alexandria,

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1/ The Potomac River Basin. An Introductory Report - 1945 Interstate Commission on the Potomac River Basin

Arlington County and Fairfax County outfall sewers. A small stream known as Cabin John Creek also discharges considerable pollution to the Potomac.

The broad tidal channel in the Washington area acts as a natural purification basin, and substantial recovery, though not complete, takes place before the waters reach Fort Washington, Maryland, about seven miles below the District of Columbia. There is no sampling data available concerning the quality of the water in the Potomac River below Fort Washington.

The Anacostia River is polluted with sewage and some industrial wastes. Results of sampling, compiled by the Interstate Commission on the Potomac River Basin show a high B.O.D. above the Bladensburg sewage treatment plant of the Washington Suburban Sanitary District. The lower six miles through the District of Columbia contained less than three p.p.m. of dissolved oxygen during a period of two months and at times approached a state of oxygen depletion with septic conditions resulting. This river cannot assimilate the pollution from the Washington Suburban Sanitary District's Bladensburg treatment plant and a program is under way for abandoning this plant and making a connection to intercept and convey the sewage to the District of Columbia Sewage Treatment Plant.

The Monocacy River flows through an agricultural section and carries excessive amounts of silt. Pollution is discharged to the stream from 10 municipalities, nine of which have treatment facilities, and from 18 industrial sources, 15 of which have treatment facilities. The pollution from the municipalities has a population equivalent of 28,130. No data were reported concerning the industrial waste discharges, which are principally from canneries, abattoirs and dairy plants.

Limited stream sampling to determine temperatures, pH value and turbidity has been conducted by the Maryland Department of Research and Education. However, an extensive sanitary survey and sampling program is planned by the Maryland Water Pollution Control Commission in cooperation with the Monocacy Valley Council.

The South River, a tributary of the South Fork of the Shenandoah River, receives considerable pollution in the Waynesboro, Virginia, area. Untreated sewage from an estimated population of 9,500 and industrial wastes having an extimated population equivalent of 58,000, are discharged with the result that the stream is deficient in dissolved oxygen for a distance of five miles below Waynesboro. At times the dissolved oxygen has dropped to less than one p.p.m. and the bacteria count has been very high.

Opequon Creek receives pollution of approximately 25,000 population equivalent in the Winchester area and 40,000 in the

Martinsburg area. Data are not available concerning the quality of water in the upper reaches of the stream. The City of Winchester, Virginia, recently placed a new sewage treatment plant in operation.

Tuscarora Creek, polluted with wastes from the Martinsburg area, discharges into Opequon Creek about 8 miles above its mouth. A sampling program conducted by the West Virginia Water Commission during the 1947 low flow period showed a deficiency of dissolved oxygen in the Tuscarora and in Opequon Creek below the entrance of Tuscarora Creek. The streams in the Martinsburg area are seriously polluted and during critical flow months both Tuscarora Creek and Opequon Creek become bad appearing, foul smelling, open sewers unsatisfactory for almost all water uses.

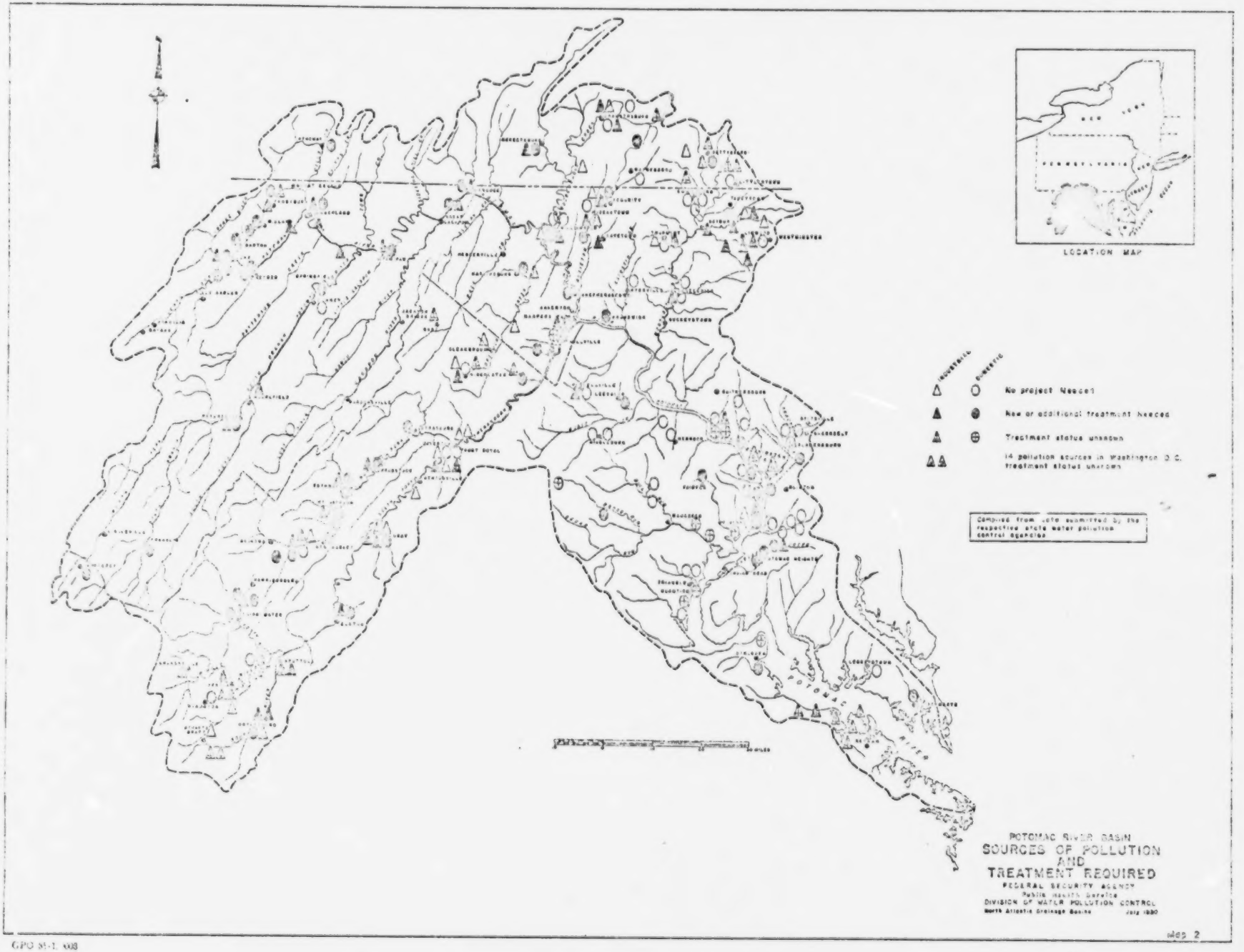
Warm Springs Run, in and below Berkeley Springs, West Virginia, is so grossly polluted during the low flow summer months as to render it objectionable and potentially hazardous for industrial use at the Pennsylvania Glass Sand Company located about two miles downstream from Berkeley Springs.

Georges Creek, which discharges to the North Branch of the Potomac at Westernport, Maryland, drains part of the coal mining area in Maryland. It is grossly polluted by acid mine water from active and abandoned coal mines and sewage from a population of approximately 9,000 in Frostburg, Midland, Lonaconing, Barton, and other communities in the general vicinity.

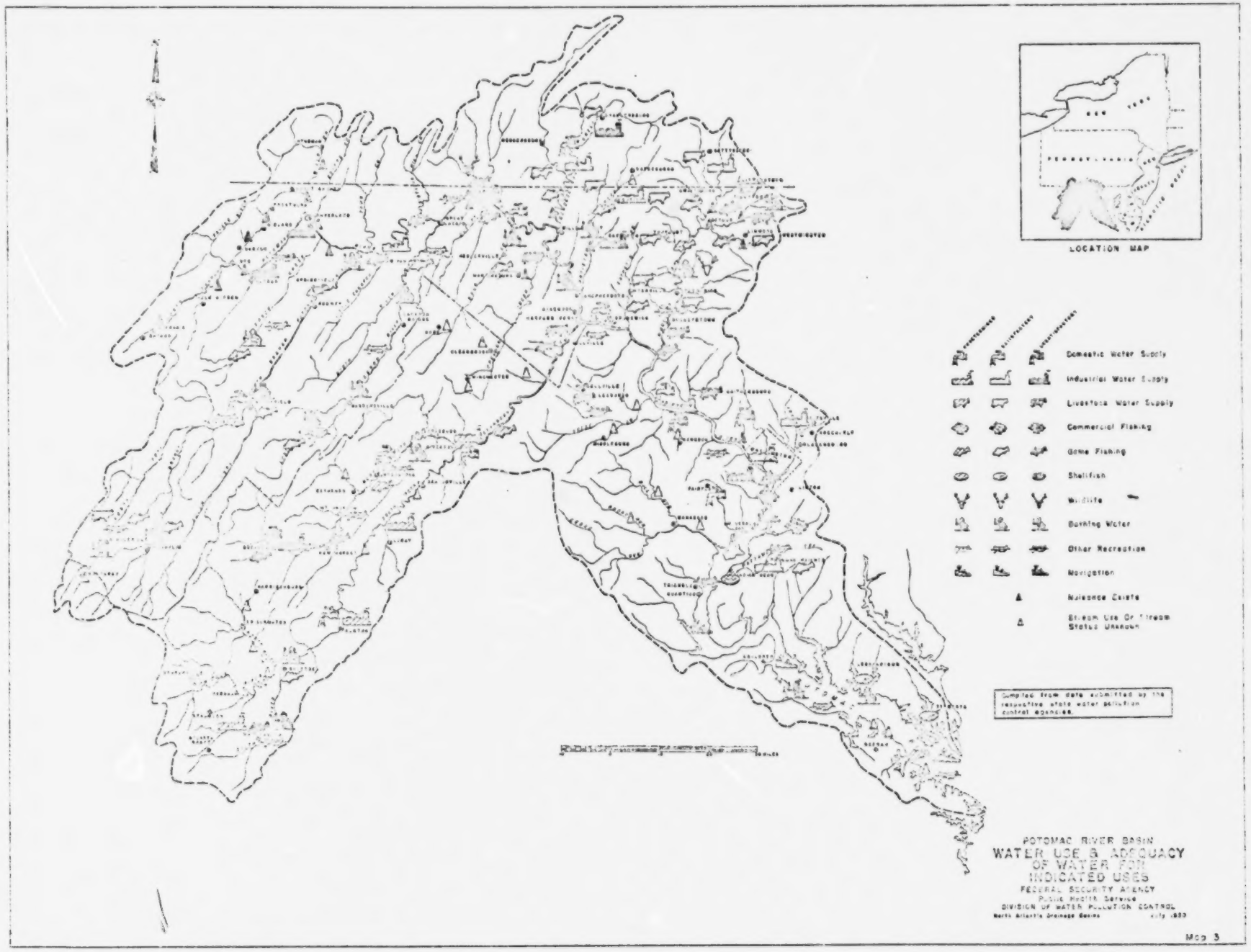
Map No. 2 shows the sources of pollution and treatment required and Map No. 3 the water use and adequacy of water for indicated uses as reported by the water pollution control agencies within the Potomac River Basin.

DAMAGES TO WATER RESOURCES

Two hundred years ago the Potomac River and all its tributaries were clean streams abounding with all kinds of fish and wildlife. As people began to settle the area, first for agricultural and later for industrial purposes, pollution of the river and its tributaries began. About 1860 soil erosion became a problem, becoming progressively worse as time passed. About 1870 pollution from domestic sewage became a nuisance in certain localities, and by the turn of the century it had become a generally recognized health menace. There was undue prevalence of typhoid fever in Washington due to a polluted water supply. Washington continued to use the Potomac River as its water supply without treatment until 1905 when the first filtration plant was built. After World War I the pollution problem from domestic sewage became serious. Pollution from industrial wastes and acid mine drainage had become a serious problem in the Cumberland, Maryland area as early as 1910. During the last three decades all types of stream pollution have materially increased.


LOCATION MAP
INDUSTRIAL
DOMESTIC
No project Needed
New or additional treatment needed
Treatment status unknown
14 pollution sources in Washington D.C. treatment status unknown
Compiled from data submitted by the respective state water pollution control agencies
POTOMAC RIVER BASIN
SOURCES OF POLLUTION
AND
TREATMENT REQUIRED
FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
North Atlantic Drainage Basins
July 1950
Map 2

GPO 85-1 008


LOCATION MAP
Domestic Water Supply
Industrial Water Supply
Livestock Water Supply
Commercial Fishing
Game Fishing
Shellfish
Wildlife
Bathing Water
Other Recreation
Navigation
Nuisance Exists
Stream Use Or Stream Status Unknown
Compiled from data submitted by the respective state water pollution control agencies.
POTOMAC RIVER BASIN
WATER USE & ADEQUACY OF WATER FOR INDICATED USES
FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
North Atlantic Drainage Basins
July 1953
Map 3

Epidemics

The records show that the undue prevalence of typhoid fever in Washington prior to 1905 can be accounted for only by an impure water supply, the city having used the Potomac River as its source of drinking water supply from December 1863 until October 1905 without purification. Two epidemics of typhoid fever in communities above Washington produced calamitous results in the District of Columbia. The first was an epidemic at Cumberland, Maryland, between December 10, 1889, and June 1890, resulting in 97 deaths. Soon after, typhoid appeared at Hancock, 60 miles downstream, and in unusual measure in Washington until March 1890. In the Capital there were 213 deaths from typhoid in 1889 and 257 in 1890.1/ The second epidemic occurred in 1904 at Mount Savage, located along Jennings Run about 10 miles west of Cumberland and 185 miles above Washington. One hundred twenty cases of typhoid appeared in Mount Savage where sewage was discharged into Jennings Run which flowed into Wills Creek and then into the Potomac River. It was concluded that the typhoid at Mount Savage caused that in Washington which continued through October 1904. In that year there were 135 deaths from typhoid in Washington.1/ In 1913 an epidemic in Westernport, Piedmont, and Luke involved 274 cases.

Public Water Supplies

Due to pollution from acid mine wastes, industrial wastes, and municipal sewage, the North Branch of the Potomac has been classified by the West Virginia Water Commission as unsatisfactory as a source of water supply.

The main stem from the confluence of the North and South Branches to a point just below the Cacapon River, and from Hancock, Maryland, (which discharges its sewage untreated into the River) to a point five miles below the mouth of Opequon Creek, has also been classified as unsatisfactory for public water supply. The stretches of the stream not classified unsatisfactory - a [illegible] mile stretch from Cacapon River to Hancock and a 10 mile stretch above where the Shenandoah River enters - need complete and auxiliary treatment to remove the effects of pollution before the water can be used.

Cumberland, Maryland, had to abandon its former water supply from the North Branch and secure a supply by construction of dams on Evitts Creek in Pennsylvania. This involved a large expenditure of money for acquisition of land in the watershed and flooded area, for construction of impounding facilities, and for a pipe line extending six miles from the reservoirs to the

Reproduced from best available copy.

1/ Typhoid Fever, Geo. C. Whipple, John Wiley & Sons, New York, 1908

filtration station at Cumberland. This supply is seriously limited and inhibits industrial expansion.

Prior to installation of corrective measures the creosote wastes from the Koppers plant at Green Springs created taste and odor conditions in the Potomac River. This affected the water supply of Hagerstown and Washington requiring additional treatment costs for both municipalities.

Industrial Water Supplies

The effect of pollution in restricting use of the Potomac as a source of industrial water supply is being felt particularly by the types of industry predominant in the basin, especially the textile, pulp and paper, and chemical industries.

Future industrial expansion is also threatened. Recently the DuPont Company decided against locating a plant at Brunswick on the Potomac because of the poor water quality of the river in this area.

Industries located in the basin are experiencing difficulties because of poor quality and inadequate quantity of water available to them for process and cooling purposes.

The Celanese Corporation at Amcelle, just above Cumberland, Maryland, on the North Branch of the Potomac River, operates its own water filtration facilities for industrial uses. There have been occasions when the quality of the water from the stream has been so unsatisfactory as to place an excessive burden on the filtration facilities, with the result that some of the products have been affected and have had to be discarded. During periods of low flows, operations have been seriously upset, and in a few cases, major departments have had to be shut down. This situation develops only when the supply of water from the City of Cumberland is curtailed and the supply of process water must be augmented by treated river water. The Corporation may purchase only 4,000,000 g.p.d. from the limited public supply of the City of Cumberland. Periods of shut-down have resulted in loss of wages to the employees and the loss of revenue to the Corporation.

The Potomac Edison Company operates steam-power plants along the river at Cumberland, Williamsport, and Brunswick, Maryland. Extensive damage has been caused because of growths in the condenser tubes at the Cumberland plant. These tubes need to be replaced considerably more often than at the other two plants even though the Williamsport plant uses twice as much water.

The Kelly Springfield Tire Company at Cumberland previously used water from the North Branch of the Potomac River in its condensers, but because of pollution now has to obtain water from the Cumberland public supply for cooling the process vats.

The Potomac Electric Power Company has two plants in Alexandria. One, known as the old plant, uses 60,000,000 g.p.d. The other is the new Potomac River station, placed in operation in the summer of 1949 which uses from 80 - 100,000,000 g.p.d. It is expected that water consumption at the new Potomac River station will increase to approximately 193,000,000 g.p.d. when the second generating unit is placed in operation during June 1950. The new plant encountered early trouble with growths and deposition of solid materials in the condensers caused by pollution of the Potomac River supply. A recent estimate of the cost of chlorination to treat the water to eliminate the trouble is placed at approximately $80,000 per year.

Navigation

The most serious pollution affecting navigation is that due to silt (soil erosion). This results in heavy deposits in the navigable channels in the tidal areas of the Potomac River, necessitating frequent dredging operations to maintain the channel depths.

In addition, it has been estimated that sewage pollution of the Anacostia River has caused damages of $200,000[1/] a year to navigation and shore installations due to the corrosive effect of hydrogen sulfide liberated during times when septic conditions prevail.

Aquatic Life

Game[2/] fishing in the upper Potomac River has been either completely destroyed or seriously restricted to the headwater streams due to pollution. Only a few palatable fish are found. Where catfish do occur they are often not palatable because of pollution.

In the North Branch fishing is poor and the fish that do occur are not palatable. The Shenandoah, once considered one of the best bass streams in the eastern United States, has become fishless in its lower reaches in Virginia and West Virginia due to industrial waste discharges which have wiped out aquatic life. This stream is now recovering.

It has been reported that oyster beds on the Potomac just above the Wicomico River have been damaged from silt covering them.

1/ Page 635, Part 2 - District of Columbia Appropriations for 1951 - Hearing before the Sub-Committee of the Committee on Appropriations, House of Representatives.

2/ Potomac Basin Zoning Report - West Virginia Water Commission, July 1, 1948

Recreation

The streams in the Basin have many recreational uses. Summer camping locations range from individual cottages to large industrial and welfare camps as well as State and Federal parks situated mainly on the tributary streams that are not heavily polluted. The Main Stem and North Branch in West Virginia have been classified either as unsatisfactory or poor recreational waters. With reference to the continued tourist travel in West Virginia, the West Virginia Water Commission in its 1948 Potomac Basin Zoning Report states: "These values will be continued at their present level and increased only if the trend of stream pollution destruction can be stopped."

In the Washington area the Potomac River is unsafe for swimming because of the existing pollution, the results of surveys indicating the necessity of going downstream as far as Quantico before suitable bathing areas are available. Full utilization of the proposed recreational areas along the Potomac from Great Falls to Mount Vernon can not be had with the present pollution discharged from Washington, Arlington, Alexandria, and from the Anacostia River.

BENEFITS RESULTING FROM POLLUTION PREVENTION & ABATEMENT

Reduction of pollution, including municipal, industrial, and silt, in the streams of the Potomac Basin will result in many benefits, some tangible and others intangible.

Public Water Supply

A direct benefit resulting from pollution prevention and abatement will be a reduction in the hazard placed upon public water supplies particularly during periods of low stream flow or during periods of heavy demand such as occurred at Washington, D.C. in June and July 1949. In the period of June 21-25 the average production of the filter plant, 209.44 m.g.d., exceeded the rated capacity of the filters by 13 per cent. On July 29, with consumption at 241.67 m.g.d. the rated capacity was exceeded by 31 per cent. Such overloading of filters increases the potential health hazard in case other safeguards should fail.

The reduction in soil erosion will materially reduce the turbidity that has to be removed from the water to make it potable, particularly in the Washington area. It has been estimated that if the turbidity of the River can be reduced to below 100 p.p.m. for 95% of the time, the City of Washington will save $50,000 per year in the cost of treating its water.3/

3/ Harold A. Kemp - Solid Pollution in the Potomac River Basin - Interstate Commission on the Potomac River Basin, P.9, 1949

Industry

Reduction in industrial pollution is beneficial not only to the watercourse which has been receiving the plant effluent, but also to the operating economy of the plant. Profits may result from pollution abatement measures which involve changes in plant processes. Recovery as by-products or reuse of materials formerly wasted are typical examples of common benefits.

In the Potomac Basin several plants have instituted recovery steps. A large paper mill is now recovering charcoal and chalk from the plant effluent, both providing important sources of revenue. The former material is made into activated carbon which has widespread use in water supply plants and is also used in various manufacturing processes. This same plant is improving the efficiency of its soda recovery in the pulping system by the installation of modern equipment which will materially reduce the amount going to the stream and to the atmosphere.

In some cases wastes from food processing plants and agricultural operations which formerly were discharged to the streams and caused pollution are now being recovered for silage or disposed of on farm land for their fertilizing value.

Navigation

Reduction in the cost of maintenance of boats, piers, and other waterfront structures will result from improved stream conditions. It has been estimated that 90% of the silt carried by the Potomac River drops out of suspension in the Washington area, which necessitates continual dredging to keep the navigable channel open. A saving of $60,000 per year in dredging costs could be effected if turbidities were reduced for a major portion of the time to 100 p.p.m.[4/]

Aquatic Life

By adequate treatment of the plant effluent from the synthetic fiber plant at Front Royal, Virginia, this stretch of the Shenandoah is now recovering from the extremely toxic pollution that had been discharged into it, as indicated by tests conducted by the U. S. Fish and Wildlife Service. With the recovery of aquatic fauna the stream was restocked with bass in the fall of 1949. During the summer of 1950 aquatic life of all kinds became more abundant and reproduction of bass and other fish is evident in all sections of the river.

The excessive soil load carried by the Potomac is not only a cause of concern to water plant operation and navigation

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4/ Harold A. Kemp - Soils Pollution in the Potomac River Basin - Interstate Commission on the Potomac River Basin, P. 9, 1949.

interests, but also is a factor in limiting the rate of stream recovery from pollution. Silt coats the stream bottom and while in suspension prevents the penetration of light, thus reducing the capacity of the stream to support biological and plant life so necessary to assimilate the organic pollution discharged into it. The blanketing of the tidal areas of the Potomac with silt deposits has been blamed in part for the decrease in the productivity of the oyster bars. The reestablishment of these oyster producing areas to their former condition cannot take place until adequate soil erosion control has been accomplished in the upper reaches of the Potomac Basin.

Recreation

The Potomac Basin, one of the country's most popular recreational areas, can never fully realize its ultimate recreational development without an adequate pollution abatement program. Within the Basin the Federal Government has approximately one million acres of land consisting of national parks or national forest areas where recreation is being developed and where the potential is great. In addition, many State parks and forests provide recreational facilities. Proposals have been made for a recreational parkway from Washington, D.C. to Cumberland, Maryland, along the C & O Canal.

Thousands of people visit the Nation's Capital every year and participate in the recreation provided in the area. The value of protecting the recreational pursuits in the Potomac River Basin and assisting in their development through adequate pollution control may be intangible but may very well outweigh all other benefits combined. The use of the Potomac River, for instance, in the Washington Metropolitan Area as a recreational asset rather than as a sewage treatment plant, would be of inestimable value to the residents of this area.

POLLUTION PREVENTION MEASURES IN EFFECT

Existing Treatment Facilities

A summary of the data concerning existing municipal treatment facilities submitted by the Water Pollution Control Agencies within the Potomac River Basin is set forth in Table C. Facilities are provided for treating the waste waters from 86 municipal or institutional sources which serve a population of approximately 1,400,000, over 87% of the estimated sewered population of the Basin. About 70% of the sewered population is served by 34 primary treatment plants and 17% is served by 53 secondary treatment plants.

No treatment facilities are provided for the remaining 13% of sewered population, representing 50 municipal or institutional sources of pollution.

TABLE C

EXISTING TREATMENT FACILITIES

MUNICIPAL

Degree of Treatment Provided	Municipalities(*)	Plants	Population Served
Primary	34	34	1,115,193
Secondary	52	53	272,571
No Treatment	50	xx	209,175
TOTAL	136	87	1,596,939

(*) Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

Waste treatment facilities are provided at 53, or one-half, of the industrial sources of pollution within the Potomac River Basin. No treatment facilities are provided at 32 industrial plants and additional information is needed to determine the status at 17 establishments. It is noted that approximately 53% of the establishments are related to food and kindred products with approximately one-half having waste treatment facilities. Mining activities, such as sand and clay quarries and washeries producing inorganic waste materials, comprise about 12% of the sources of pollution and two-thirds of these have treatment facilities.

TABLE D

EXISTING TREATMENT FACILITIES

INDUSTRIAL(*)

Type of Industry	No. of Plants	Number of Industrial Plants Having: Treatment Facilities	No Treatment Facilities	Undetermined Facilities
Manufacturing				
Food and Kindred Products	54	26	23	5
Textile Mill Products	5	5	-	-
Paper and Allied Products	3	1	1	1
Chemical and Allied Products	2	1	1	-
Rubber Products	1	1	-	-
Leather and Leather Prod.	5	5	-	-
Miscellaneous	20	6	3	11
Non-Manufacturing				
Other Mining Industries	12	8	4	-
TOTAL	102	53	32	17

(*) Industries having separate outlets and discharging wastes directly to watercourse.

Adequacy of Existing Treatment Facilities

Approximately 53% of the existing municipal or institutional sewage treatment plants are of adequate design and operated in a satisfactory manner, but 27% are unsatisfactory as to design and operation. No data were reported concerning the design or operation of the remaining 20%.

Industrial waste treatment facilities are satisfactory in approximately 38% of the establishments, unsatisfactory in 34%, and undetermined for the remaining 28%.

TABLE E

ADEQUACY OF EXISTING TREATMENT FACILITIES

		Adequacy with Relation to:					
		Capacity			Operation		
Facilities	Number	Satisf.	Unsat-isfac.	Undeter-mined	Satisf.	Unsat-isfac.	Undeter-mined
Municipal	87	46	24	17	47	22	18
Industrial	53	20	18	15	23	15	15
	Population Served						
Municipal	1,387,764	1,111,971			1,157,283		74,900
		216,893		58,900		155,581	

Progress in Pollution Abatement

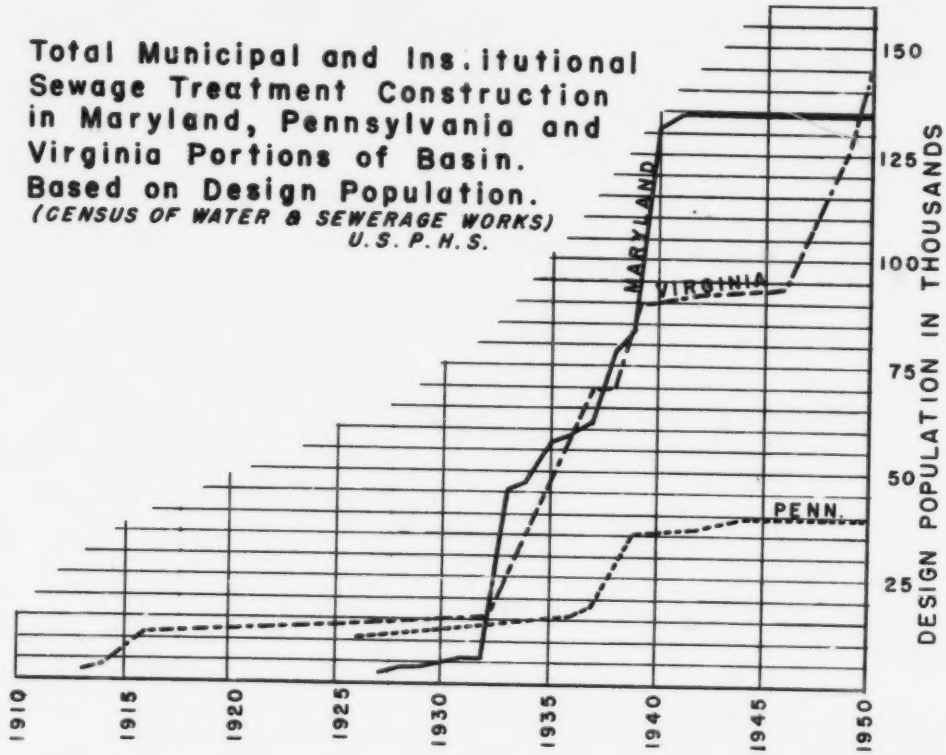
Pollution prevention measures in the Potomac River Basin have been rather typical of the pattern followed by the country at large. Control was originally vested in the respective State health departments and authority was limited to a large degree to situations wherein the public health was directly affected.

A few sewage treatment plants were constructed during the second decade of the 20th Century, but no real progress took place until the 1930's when Federal aid in the form of work relief or grants provided a tremendous impetus to municipalities to develop projects of some type. Figure 2 illustrates graphically the progress in pollution abatement in terms of design capacity and number of plants constructed. A complete list of these is set forth in Appendix I.

Attention is directed to the interruption in the construction of sewage treatment plants for nearly ten years as a result of the two world wars. The present emergency and the probable increased demands for clean domestic and industrial water makes it imperative that steps be taken to protect our vital water resources and to prevent the repetition of past mistakes.

It became evident that something more than the tremendous assistance offered by the Federal Government during the depression 1930's would be necessary to provide clean streams. It was

POTOMAC RIVER BASIN



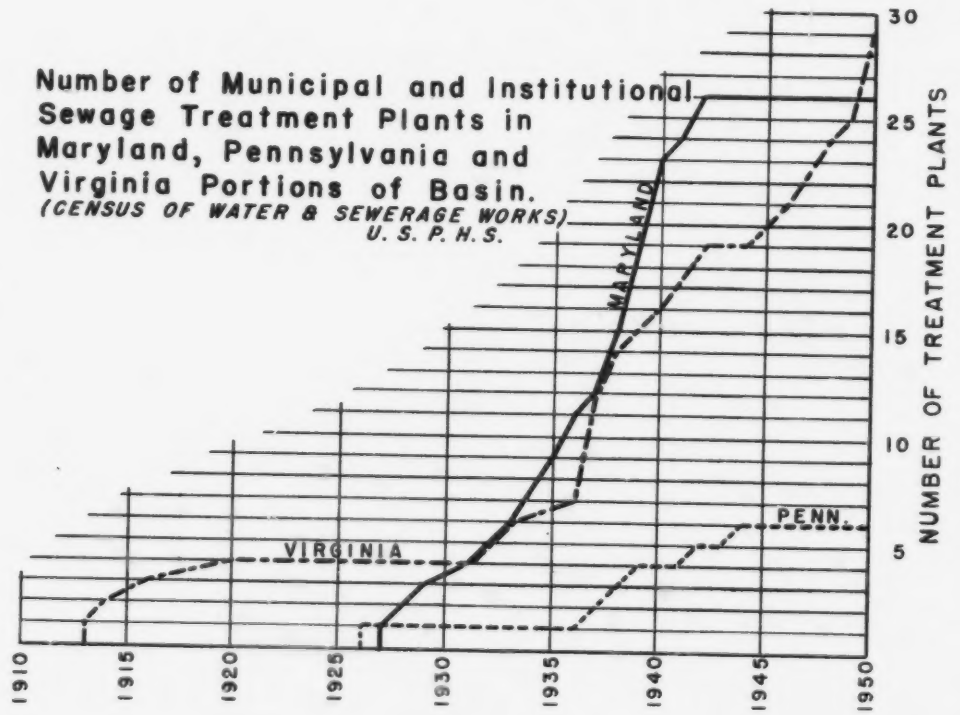


Figure 2

GPO 85-170008

apparent that, because of the interstate nature of the Potomac, some agency was needed to promote uniformity of approach throughout the Basin. After several years of planning for it, the Interstate Commission on the Potomac River Basin was formed in 1941, and became active that year, although the Governor of Pennsylvania did not sign the compact until 1945.

The Interstate Commission on the Potomac River Basin has no enforcement powers. Its purpose is to promote uniformity of action among the various State agencies having jurisdiction over various aspects of pollution within the Basin. It promotes improved and uniform State legislation and has been an influential factor in this respect. A principal function is to promote informational programs to acquaint the public with the problems at hand.

The State of Virginia created the Water Control Board in 1946, and the State of Maryland created the Water Pollution Control Commission in 1947. The Maryland State Department of Health is invested with authority to approve and pass on plans and specifications for sewage treatment plants and on all other public health matters but the Water Pollution Control Commission may take action in any case where there are waste discharges contributing to the pollution of any waters of the State. Both Pennsylvania and West Virginia had water pollution control boards, the former called the Sanitary Water Board, set up within the State Department of Health, and the latter called the State Water Commission. The authority of the Pennsylvania Sanitary Water Board, however, was strengthened in 1945, and numerous amendments to the West Virginia laws have been enacted. Generally, it can be said that water pollution control legislation is adequate to care for the pollution problems within the Potomac River Basin with the exception of the exclusion of acid mine drainage. Also, West Virginia has no jurisdiction to prevent discharge of culm.

While the approach of the various State agencies is somewhat different, the underlying philosophy and basic principles are substantially the same. Pennsylvania is proceeding on the basis of requiring complete treatment of all municipal wastes and an equivalent degree of treatment for all industrial wastes discharging to all streams in the Potomac Watershed.

The West Virginia Water Commission established four water quality classifications for streams prior to 1941. As a result of its field surveys and sampling programs during the summers of 1946 and 1947, the Commission classified the State waters in the Potomac Basin into these four classes and established zones in accordance with conditions found. The Commission has mapped out a program for elevating the water quality in each of the zones so that eventually it will meet standards commensurate with desirable uses.

The Interstate Commission on the Potomac River Basin, in order to establish a uniform measure for water quality, approved on August 8, 1946, "Minimum Water Quality Criteria for Streams in the Potomac River Basin" and recommended their use by the States in the Basin. These criteria also established four classifications comparable to those adopted by the West Virginia Water Commission but with different ranges in the various criteria.

The State of Maryland Water Pollution Control Commission, on February 18, 1949, officially adopted criteria for the classification of Maryland streams. These criteria are the same as those of West Virginia. Maryland also adopted regulations specifying standards for industrial wastes which are to be applied to all industrial wastes within the State irrespective of the location of the industry. These standards are minimum and may not be exceeded by industry. However, where necessary to protect legitimate water uses, the minimums may be made more stringent. This Commission is young and has proceeded on the policy of cooperation with municipalities and industries involved. However, it is becoming more aggressive and exercises its powers of enforcement when breaches of faith occur.

The Virginia Water Control Board is committed to preventing any new or increased pollution and to a gradual reduction of old or existing pollution. It has no published standards but is exerting pressure on individual offenders, taking each case and considering the action required on the merits of each case. Evidence of effective post-war progress appears in Figure 2.

Appendices J, K and L show the water quality sampling stations operated cooperatively by the States, municipalities and industries in the program of the Interstate Commission on the Potomac River Basin, and the results of analyses of 1,984 samples collected during the period of July 1, 1948, to June 30, 1949. Results of 212 samples collected from 75 stations by the West Virginia Water Commission during October 1949 are not included.

The Interstate Commission on the Potomac River Basin, after reviewing the data available, has given consideration to revisions of its water quality criteria. The Technical Committee of the Commission has approved proposed revisions which will be considered by the Commission for adoption and recommendation to the States. It is desirable that similar consideration be given to these by the several signatory States in order that unified criteria may be adopted to serve as a common basis in a basin-wide pollution abatement program.

The Interstate Commission on the Potomac River Basin has been a strong influence toward pollution control and abatement

since its formation. Its strength lies in a public relations and publicity program designed to acquaint the people with the problems involved and to formulate public opinion. Through its efforts industry has been made a partner in the tremendous undertaking of reclaiming the Potomac Basin and industry's attitude now is one of cooperation.

Before most industries in the Potomac River Basin install additional processing equipment, engineers in charge must now report to top management of their companies concerning the possible effect of the new installations on pollution of the streams into which the wastes are discharged. The management must be satisfied that such operations will not seriously increase pollution of the waters receiving the wastes. Research in waste treatment is carried along with the research that develops new products. This is a phase of operation that most industries neglected entirely not many years ago.

Practically all industries within the Basin are considering proposals for reduction of wastes by construction of treatment works, process changes in manufacturing, or other methods. This is a noteworthy accomplishment and reflects substantial progress, although much of such progress has not as yet been translated into actual abatement. Such undertakings frequently have to be synchronized with normal plant expansion programs or plant renovation programs. However, real progress in pollution abatement has been made by some of the industries, with measurable benefit to the river.

Waste treatment at Front Royal by the American Viscose Company has been effective and the stream below Front Royal has recovered to a large degree. Biological organisms are beginning to reappear and fish are revisiting the area. This stretch of the Shenandoah was considered a biological desert for some time because of previous pollution.

Municipalities with sewage treatment works include Chambersburg, Gettysburg, Littlestown, and Waynesboro, Pennsylvania; Front Royal, Harrisonburg, Herndon, Leesburg, Manassas, Middleburg, Staunton, and Winchester, Virginia; Charlestown, Martinsburg, and Romney, West Virginia; Bladensburg Plant of the Washington Suburban Sanitary District; Frederick and Hagerstown, Maryland; and Washington, D.C. Some of these plants are overloaded and inadequate. However, it is a credit to these communities that they have discharged, at least in part, their obligations to treat community wastes before discharging into public waters. Winchester, Virginia has recently completed and placed in operation a new plant for treating its municipal and industrial wastes, costing approximately $1,000,000. This enterprise shows how cooperation between municipalities and industry can be mutually beneficial and should be encouraged. Front Royal has recently completed the construction of its new sewage treatment

plant at a cost of more than $200,000. During the past year $1,400,000 was spent for additional treatment facilities at the Washington Blue Plains Plant.

The people within the Potomac Basin are becoming more and more conscious of the recreational value of the Potomac and its tributaries and are demanding that this asset be protected and preserved. The trend of urban dwellers to move into suburbs and avail themselves of the advantages afforded constitutes a powerful impetus toward more stringent pollution control.

Progress in the construction of pollution abatement works is shown in the following table.

TABLE F

PROGRESS IN POLLUTION ABATEMENT

Year	Plants Completed	Design Population	Plants Completed	Amount of Waste Treated (In Terms of Equivalent No. of People)
1946	1	300	Data	
1947	-	-		
1948	4	4,360		not
1949	1	31,000		available

Soil Conservation

As of January 1, 1950, twenty soil conservation districts, organized under State laws and managed by locally elected supervisors, have been organized within the Potomac River Basin. These districts, whose common objective is the conservation of soil and water, contain 59,400 farms and cover an aggregate area of 9,900,000 acres. In the course of its assistance to these districts, the Soil Conservation Service has prepared 9,600 farm conservation plans covering an aggregate area of 1,637,000 acres. The conservation work recommended in these plans, such as contour farming, terracing, cover cropping and other measures, has been completed by the land owners and operators on 808,000 acres. This work will aid in reducing the silt loading of the streams.

POLLUTION PREVENTION MEASURES NEEDED

New or improved sewage treatment plants are needed for 62 municipalities to serve a population of approximately 1,400,000. There are 50 industrial establishments which need improved or new industrial waste treatment facilities.

TABLE G

MUNICIPAL AND INDUSTRIAL WASTE TREATMENT PLANT NEEDS

	Municipal		Industrial
Requirements	Number	Population Served by Facilities	Number
New Plant	43	203,643	30
Enlargement or Additions to Existing Plant	16	1,084,430	19
Replace Existing Plant	3	94,200	1
No Project Required	54	154,724	17
Undetermined	20	59,942	35
TOTAL	136	1,596,939	102

It will be noted from Table G that 19 existing sewage treatment plants which serve about 74% of the sewered population within the Basin need improvement and 43 new plants are needed to serve about 13% of the sewered population. Currently 54 municipalities with about 10% of the population need no projects.

The data available concerning industrial waste treatment indicate that corrective measures are needed for 50 establishments, or 50% of the reported sources of industrial wastes, and additional information is needed to determine the waste treatment status at 35 establishments. Waste treatment facilities are adequate for only 17 establishments or 17% of the sources of

industrial waste pollution.

Maryland

Pollution is discharged to waters of the Potomac from 49 municipalities or institutions and from 24 industrial sources in Maryland. The waste waters are treated before discharge by 36 municipalities or institutions and by 17 industries.

In order to abate pollution of the streams it is necessary that 14 new sewage treatment plants be constructed to serve approximately 69,000 people. These plants are needed principally in the Georges Creek area and along the North Branch of the Potomac River at Frostburg, Midland, Lonaconing, Barton, Luke, Westernport, Mount Savage, and Cumberland. Improved facilities are needed at six sewage treatment plants which serve a population of 5,870 and include the plants at Brunswick, Indian Head, Williamsport, and the Navy Model Testing Basin.

Plans are under preparation for abandoning the Washington Suburban Sanitary District's Bladensburg sewage treatment plant which serves a population of 81,000. It is proposed to discharge the sewage into the interceptor of the District of Columbia in order to reduce the pollution load on the Anacostia River.

Seventeen of the 24 industrial waste discharges receive treatment. However, new treatment facilities are needed at 12 establishments and improvements or additions to the existing treatment works at six establishments, which are principally food processing plants with the exception of some diversified industry in the Hagerstown area and a tanning industry in Williamsport.

Industrial wastes are discharged from 12 sources into the Monocacy River and from five sources into Antietam Creek.

The major sources of industrial pollution are in the Luke-Cumberland area where the West Virginia Pulp and Paper Company discharges untreated wastes having an estimated population equivalent of 110,000 and the Celanese Corporation of America discharges untreated wastes having an estimated population equivalent of 130,000. Improvements and changes in manufacturing processes which have been completed or are under way at both of these establishments will reduce the pollution load for which waste treatment facilities are needed.

Data available also indicate the need for information concerning pollution from the majority of the industries which discharge their wastes to the streams.

Pennsylvania

Domestic sewage in Pennsylvania is discharged to tributaries of the Potomac River from six municipalities - one a

State sanatorium - and two orphan's homes, with a total population of 36,900. Chambersburg, Littlestown, Waynesboro, Mont Alto Sanatorium and the two orphan's homes have sewage treatment works which provide secondary treatment. Gettysburg has primary treatment and has submitted construction plans for secondary treatment which have been approved by the Sanitary Water Board. Mercersburg and Hyndman have no treatment but have submitted construction plans for secondary sewage treatment works which have been approved by the Board.

Industrial wastes are discharged from eight canneries, two quarries, and one gas works. Further investigation is necessary to determine the status of a third quarry operation. Waste treatment facilities are provided at these 11 establishments. Four are considered satisfactory, but improvements are needed at three which are inadequate in design and operation. No report was submitted concerning the status of the other four.

Information is needed concerning the quantity and quality of effluent discharged from the sewage treatment and industrial waste treatment plants.

Virginia

Sewage treatment plants are needed for 17 municipalities in Virginia and one institution having a total sewered population of 125,000.

In the Washington Metropolitan Area improvements and new plants are needed to serve a population ov 210,000. Additions to the existing treatment plant are needed to treat all of the sewage from Arlington County. New plants are needed for Alexandria and Fairfax Counties.

Thirteen new sewage treatment plants are needed along the Shenandoah and its tributaries for municipalities with populations ranging from 350 to 7,500, and a total population of 19,000; these include Waynesboro, Luray, Elkton, Strasburg, Woodstock, and Bridgewater.

Improvement of existing sewage treatment facilities is necessary for seven municipalities having a total population of 26,000, and for six locations such as housing developments, schools, and hotels serving a population of 1,600.

Additional data are needed concerning the status of the receiving streams below the sources of domestic pollution. Reports on 11 locations indicate the streams to be unsatisfactory for the indicated use. Data are lacking concerning 39 locations.

Industrial wastes are discharged from 42 sources, 15 with treatment and 27 without treatment. Data are needed concerning

the pollution load discharged from three treatment works and 27 sources which have no treatment. Of the 15 treatment works, four should be replaced with new plants, three need enlargement or improvement, four are satisfactory, and no data are available concerning the status of four. The 27 discharges without treatment consist of 15 needing new treatment plants, 11 concerning which data were not reported, and one plant discharging inorganic wastes.

In the Shenandoah Basin there are 27 sources of industrial pollution, nine with and 18 without treatment. Three treatment works are considered satisfactory, four need replacement with new plants, and no data are available concerning two plants. New treatment plants are needed for 13 of the establishments discharging without treatment, while no report was submitted concerning the project status of five establishments discharging without treatment.

Along the Potomac main stem and its tributaries there are 15 sources of pollution, six with and nine without treatment. These sources are principally canneries and sand washeries. One of the treatment works is satisfactory, three need additions or improvements, and no data are available concerning two of them. Two new treatment plants are needed where wastes are being discharged without treatment, and no report was submitted concerning the status of the remaining seven.

West Virginia

Seventeen sources of pollution from municipal wastes were reported in West Virginia: four with treatment serving a population of 16,480, and 13 without treatment from a sewered population of 12,345.

Nine new plants are needed for the sources reported without treatment, including Paw Paw, Shepherdstown, Piedmont, Keyser, Petersburg, and Moorefield.

The four sources with treatment plants consist of one where no project is needed, one which needs enlargement of existing facilities, one which needs improved operation or utilization of existing facilities, and, the Martinsburg plant. This plant should be replaced.

There are 10 sources of industrial waste pollution, nine with treatment, and one with the status not reported. However, no data are available concerning the discharge from six of the industrial sources of pollution.

Tuscarora Creek, a tributary of Opequon Creek, is the most seriously polluted stream in the West Virginia portion of the Potomac River Basin because of the industries at Martinsburg.

During 1949 four industries in Martinsburg connected to the city sewers, and they are to contribute to the city for the treatment of their wastes. It appears that this problem may be solved by the construction of a municipal sewage treatment plant to include treatment of the industrial wastes, some of which will require pre-treatment by the industries. This appears to be a sound policy and should be carried out with the least possible delay.

Of the 10 sources of industrial pollution, one needs treatment facilities and nine have treatment, of which seven need additions or improvements.

District of Columbia

The District of Columbia sewage treatment plant serves an estimated sewered population of 950,000. Primary treatment reduces the pollution discharged to a population equivalent of 665,000. However, to correct nuisance conditions existing in the Potomac River, it is necessary that enlargement of the plant and additions of other treatment methods be provided.

Information is lacking concerning the pollutional wastes discharged from seven industries into the Potomac and from six industries and the Navy Yard into the Anacostia River.

The status of treatment works projects to abate pollution in the Potomac River Basin and a list of project requirements are set forth in Table H and Table I.

TABLE H

STATUS OF TREATMENT WORKS PROJECTS

TO ABATE POLLUTION

July 1, 1950

Status of Project	Number	
	Municipal	Industrial
No Formal Action	28	29
Abatement Ordered	5	8
Plans Under Preparation	13	4
Construction Awaiting Financing	2	-
Under Construction	1	4
Status Undetermined	12	5
Final Plans Approved	12	5

Finance

One of the most important aspects of pollution abatement is the problem of financing the construction and operation of municipal sewage treatment works. It is also of concern to industries, particularly where the necessary capital expenditure for adequate waste treatment facilities may approach or even exceed the investment in the production facilities.

The estimated cost of the construction of sewage treatment plants and industrial waste treatment works to abate stream pollution in the Potomac River Basin will range from $40,000,000 to $50,000,000.

Outright grant-in-aid is given by Pennsylvania to its municipalities to the extent of approximately one-half the cost, at 1942 price levels, of preparation of plans for sewage treatment works but none towards the cost of construction of such facilities.

The Interstate Commission on the Potomac River Basin made a study of financing problems and recommended to officials of the member States that each of the States create a financing agency for the purpose of lending funds at a low rate of interest and furnishing legal services to municipalities, with the municipalities agreeing to service the loans by means of sewer service changes or similar type of assessment. Other measures for providing aid in financing are also being studied.

Various municipalities and industries in the Potomac River Basin have recognized their responsibilities in abating pollution created by them and have constructed treatment facilities financed through their own initiative and resources. Others have completed programs for solving financial problems encountered and are proceeding with pollution abatement projects. Postponement of construction of pollution abatement projects by municipalities or industries in anticipation of Grants-in-aid will only defer stream improvement which is long overdue.

Program Expansion

A review of Table A shows a lack of data concerning pollution discharged from about 19% of the municipal sources of pollution. Table B indicates a lack of data from about 81% of the industrial sources. Such information is essential to determine corrective action to be taken by the polluters so that the streams can be maintained in a satisfactory condition.

Considerable technical data are available concerning the quality of water in various streams in the basin. However, additional information is needed, particularly bacteriological and biological data.

The educational aspects of periodic reports of progress in water pollution control are noteworthy. Pennsylvania has an extensive program of this type and the program of the Interstate Commission on the Potomac River Basin is designed to provide information concerning the needs of the Basin and thereby motivate action. West Virginia issued its Potomac Basin Zoning Report in 1948 and the Maryland Water Pollution Control Commission issues an annual report. Expansion of these activities is desirable.

A large amount of work remains to be done in the Basin to complete the soil conservation program. It is estimated that some 350,000 acres of land now in cultivation should be converted to pasture and another 90,000 acres should be planted to trees. Soil and water conservation practices should be applied to some 1,680,000 acres of land now in critical need of conservation treatment to reduce excess runoff and soil erosion, on another 1,360,000 acres in serious need of conservation, and ultimately on some 2,880,000 additional acres in moderate need of conservation treatment. To complete the conservation job within a period of 20 years would require treatment of a total of 290,000 acres annually for the next 10 years and 310,000 acres annually for the succeeding 10 years.

Data on sediment loads of the various streams in the Basin are almost completely lacking. Wide variations occur in the amount of sediment carried by a stream and long-time continuous records of sediment discharge are needed in order to know the magnitude of the sediment loads and the effectiveness of measures for alleviating the problem.

Organizations such as the Monocacy Valley Council should be encouraged and fostered in other areas as a means of developing local participation in and appreciation of resource conservation measures, including water and soil.

The Interstate and the State Water Pollution Control Agencies need to be expanded in order for them to solve the existing problems of water pollution control and prevent any increase in pollution from new sources.

POTOMAC RIVER BASIN

TABLE I

Project List - Municipalities and Industries Needing Improvements for Abatement of Pollution

July 1, 1950

Name	Population Served	Project Needs	Remarks
District of Columbia - Municipal			
Washington	950,000	Enlargement or addition to existing plant	Under construction.
Maryland			
Barton	540	New Plant	Preliminary discussions with Allegany County Sanitary Commission.
Brunswick	1,470	Enlargement or addition to existing plant	
Cumberland	45,000	New Plant	Abatement ordered. Estimated cost $2,000,000
Frostburg	5,500	New Plant	
Hancock	780	New Plant	
Indian Head	1,000	Enlargement or addition to existing plant	
Lonaconing	2,000	New Plant	Preliminary discussions with Allegany Sanitary Commission.
Luke	900	New Plant	Preliminary discussions with Allegany Sanitary Commission.
Maryland State Reformatory for Males, Roxbury	400	Enlargement or addition to existing plant	Construction awaiting financing. Estimated cost $200,000

POTOMAC RIVER BASIN

TABLE I

Name	Population Served	Project Needs	Remarks
McCool	400	New Plant	Preliminary discussions with Allegany Sanitary Commission.
Midland	650	New Plant	Preliminary discussion with Allegany Sanitary Commission.
Mount Savage	1,800	New Plant	Preliminary discussions with Allegany Sanitary Commission.
Potomac Heights	950	New Plant	Now provides chlorinatio
Security	200	New Plant	
Taneytown	-	New Plant	No central system.
U. S. Naval Model Testing Basin, Carderock	1,200	Enlargement or addition to existing plant	
U. S. Navy Powder Factory, Indian Head	500	Enlargement or addition to existing plant	
U. S. Navy Reservation, Indian Head	2,100	New Plant	
Washington Suburban Sanitary District, Bladensburg Plant	81,000	-	Plant to be abandoned and connection made to District of Columbia for treatment.
Westernport	3,500	New Plant	Preliminary discussions with Allegany Sanitary Commission.
Williamsport (Potomac River Plant)	1,300	Enlargement or addition to existing plant	

POTOMAC RIVER BASIN

TABLE I

Name	Population Served	Project Needs	Remarks
Pennsylvania			
Gettysburg	5,910	Additions to existing plant	Plans for secondary treatment approved, construction ordered by 2/15/52. Estimated cost $216,000.
Hyndman	650	New Plant	Plans approved for complete treatment. Estimated cost $118,000.
Mercersburg	2,213	New Plant	Plans for complete treatment approved, construction ordered by 3/21/52. Estimated cost $151,000.
Mount Alto Sanitarium	1,550	Additional sludge digestion capacity.	Plans approved.
Virginia			
Alexandria	75,000	New Plant	Final plans approved 1948, estimated cost $2,200,000.
Arlington Co.	20,000	New Plant	Plan to convey sewage to existing plant location.
Arlington Co.	105,000	Enlargement or addition to existing plant	Existing plant, plans approved 1947. Estimated cost $2,000,000.
Augusta Military Academy, Fort Defiance	350	New Plant	
Berryville	1,200	Enlargement or addition to existing plant	Engineers preliminary report completed. Estimated cost $46,000.
Bridgewater	1,300	New Plant	

POTOMAC RIVER BASIN

TABLE I

Name	Population Served	Project Needs	Remarks
Broadway	450	New Plant	
Colonial Beach	2,500	Enlargement or addition to existing plant	
Dayton	980	New Plant	Preliminary report completed, estimated cost $50,000
Edinburg	600	New Plant	Engineers employed
Elkton	1,500	New Plant	
Fairfax	1,200	Replace existing plant	Final plans approved 1947.
Fairfax County Sanitary Dist. #1	10,000	New Plant	Preliminary plan completed, estimated cost $3,000,000.
Harrisonburg	8,600	Enlargement or addition to existing plant	Final plans approved 1948, Estimated cost $308,000.
Leesburg	2,000	Enlargement or addition to existing plant	Engineers employed.
Luray	1,500	New Plant	Preliminary plans completed, estimated cost $50,000.
Monterey	300	New Plant	Preliminary report completed. Estimated cost $25,000
Mount Jackson	500	New Plant	Plans in preparation
Mount Vernon	400	New Plant	
New Market	775	New Plant	Final plans approved. Estimated cost $80,000
Ochney Springs	300	Enlargement or addition to existing plant	

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POTOMAC RIVER BASIN

TABLE I

Name	Population Served	Project Needs	Remarks
Strasburg	1,500	New Plant	Preparing plans
Timberville	560	New Plant	
Waynesboro	7,500	New Plant	Final plans approved 1948. Estimated cost $850,000.
Woodstock	1,500	New Plant	Preparing plans.
West Virginia			
Berkeley Springs	700	New Plant	
Charlestown	1,500	Enlargement or addition to existing plant	Final plans approved
Franklin	200	New Plant	
Harpers Ferry	250	New Plant	
Keyser	4,500	New Plant	
Martinsburg	12,000	Replace existing plant	Plans in preparation
Moorefield	950	New Plant	
Paw Paw	800	New Plant	Plans completed Construction stopped during war. Awaiting financing
Petersburg	1,000	New Plant	
Piedmont	2,400	New Plant	
Shepherdstown	945	New Plant	

POTOMAC RIVER BASIN

TABLE I -

Name	Population Equivalent	Project Needs	Remarks
Maryland - Industrial			
Buckeystown Canning Co., Buckeystown	-	Enlargement or addition to existing plant	Cooperating with State Water Pollution Control Commission on Chemical Treatment Plant.
W. D. Byron & Sons, Inc., Williamsport	-	New Plant	Has settling tank. Cooperating with State Water Pollution Control Commission on Chemical Treatment Plant.
Celanese Corp. of America, Amcelle	-	New Plant	Recovery methods used to reduce original quantity of wastes. Abatement of pollution ordered. Estimated cost $1,000,000
Central Chemical Co., Hagerstown	-	New Plant	Has settling tank. Abatement of pollution ordered Estimated cost $5,000.
Cumberland Brewing Co., Cumberland	-	New Plant	
Eagle Poultry Co., Taneytown	-	Enlargement or addition to existing plant	Has screens.
Hancock Canning Co., Hancock	-	Enlargement or addition to existing plant	Wastes discharge to Lagoon. Abatement of pollution ordered. Estimated cost $5,000.
E. J. Nusbaum Co., Taneytown	-	Enlargement or addition to existing plant	Has screens.
Queen City Brewing Co., Cumberland	-	New Plant	
A. H. Smith Sand & Gravel Co., Branchville	-	New Plant	Abatement ordered

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POTOMAC RIVER BASIN

TABLE I

Name	Population Equivalent	Project Needs	Remarks
Southern Packing Co., Cavetown	-	New Plant	Cooperation with State Water Pollution Control Commission. Construction of Chemical Precipitation Plant
Thomas & Co., Adamstown	-	Enlargement or addition to existing plant	
Joseph Weller Canning Co., Linwood	-	Replace existing plant	Solids are collected and deposited on fields
West Virginia Pulp & Paper Co., Luke	-	New Plant	Stream is acid - recovery methods used to reduce original quantity of wastes. Abatement of pollution ordered. Estimated cost $1,000,000.
Western Maryland Dairy, Detour	-	New Plant	Cooperating with State Water Pollution Control Commission, on waste treatment studies.
Western Maryland Dairy, New Windsor	-	New Plant	
Western Maryland RR. Co., Hagerstown	-	New Plant	Oils, grit, caustic solution from washing operations. Treatment facilities under construction. Estimated cost $50,000.
Willow Farms Dairy Co., Frizzelburg	-	New Plant	
Pennsylvania			
H. J. Heinz Co.,	-	Enlargement or addition to existing plant	Existing treatment works inadequate. Under orders to abate pollution. Awaiting action by Borough of Chambersburg to admit wastes to municipal sewage treatment works. Boro estimates $40,000 cost of necessary additional facilities.

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POTOMAC RIVER BASIN

TABLE I

Name	Population Equivalent	Project Needs	Remarks
Lowengart & Co., Franklin County	-	Enlargement or addition to exiting plant	Original plans for treatment now inadequat Abatement ordered. Esti mated cost $14,000.
National Fruit Products Co., Chambersburg	-	Enlargement or addition to existing plant	Treatment works allowed to deteriorate. Abatement ordered. Estimated cost $10,000.
Virginia			
Celanese Corp. of America, Verona	167	New Plant	Sewage discharge
Clearbrook Woolen Mills, Clearbrook	-	Enlargement or addition to existing plant	Has vibrating screens
J. Lynn Cornwall, Inc., Purcellville	4,300	New Plant	Has catch basin to remove portion of settleable solids. Engineer engaged.
Crompton-Shenandoah Co., Waynesboro		New Plant	Has settling tank.
Duplan Corp., Grottoes	-	New Plant	Sewage treatment plant needed
Edinburg Poultry Dressing Plant	-	New Plant	
DuPont Rayon, Waynesboro	Sew- 2,000 I.W.	New Plant	Has lagoons for lime sludge. Waste reduced about 50% in process. Reduction to 30% of 194 load expected by 8/1/50
Jackson Meat Market, Mount Jackson	-	New Plant	
Luray Textile Corp., Luray	-	New Plant	

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POTOMAC RIVER BASIN

TABLE I

Name	Population Equivalent	Project Needs	Remarks
Mayer Brothers Luray	-	New Plant	
Merck & Co., Elkton	-	New Plant	Under construction
Mill Creek Cannery, Mount Jackson	-	New Plant	
Northern Virginia Construction Co.		New Plant	Settleable solids and discoloration. Needs settling facilities.
Old Virginia Packing Co., Front Royal	-	New Plant	Solids disposed of on land.
Oscar Webel Hosiery Corp., Verona	-	New Plant	Sewage discharge.
O'Sullivan Rubber Co., Winchester	500	Enlargement or addition to existing plant	Under construction
Rockingham Poultry Mktg. Coop., Broadway	-	New Plant	
Valley Meat Co., Harrisonburg	-	New Plant	Under construction
Virginia Canfoods, Inc., Timberville	-	New Plant	
Virginia Farms, Inc., Verona	-	New Plant	
Virginia Oak Tannery, Inc., Luray	-	Enlargement or addition to existing plant	Lagoons with regulated discharge.

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POTOMAC RIVER BASIN

TABLE I

Name	Population Equivalent	Project Needs	Remarks
West Virginia			
Mailtown Paper Board Co., Mailtown	-	Enlargement or addition to existing plant	Has screens - Plans under preparation
Keystone Lime & Stone Co., Millville	-	Enlargement or addition to existing plant	Plans under preparation
Keystone Tanning & Glue Co., Moorefield	-	Enlargement or addition to existing plant	
Keystone Tanning & Glue Co., Paw Paw	-	Enlargement or addition to existing plant	
Keystone Tanning & Glue Co., Petersburg	-	Enlargement or addition to existing plant	
Koppers Co., Green Springs	-	New Plant	Plans under preparation
Penna. Sand Glass Co., Berkeley Springs	-	Enlargement or addition to existing plant	Inorganic material.
Standard Lime & Stone Co., Millville	-	Enlargement or addition to existing plant	

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APPENDIX A

DRAINAGE CHARACTERISTICS - POTOMAC RIVER

Reach	Elevation, Ft. Above Mean Sea Level	Distance Miles	Fall in Feet		Average Width of Stream, Ft.	Drainage Area, Sq. Miles
			Total	Per Mile		
Junction of North & South Branches	520					2820
To		46	134	2.9	340	
Hancock, Maryland	386					4073
To		66	115	1.7	500	
Harpers Ferry, West Virginia	271					9366
To		7	55	7.9	1350	
Brunswick, Maryland	216					9420
To		32	39	1.2	1300	
C & O Canal Feeder Dam No. 2	177					11390
To		18	177	9.8	900	
Washington, D.C. (A)	(B)					11580
To		116	-	-	15000	
Mouth of Potomac River	(B)					14500

(A) --- At Chain Bridge
(B) --- Water Level Affected by Tide

APPENDIX B

PRINCIPAL TRIBUTARIES - POTOMAC RIVER

Stream		Length Miles		Average Fall, Feet Per Mile	Drainage Area, Sq. Miles	Junction in Miles Above Mouth of Potomac
North Branch		97		21.3	1328	285.1
South Branch		133		11.0	1488	285.1
Cacapon River		112		9.1	682	247.9
Conococheague Creek		76		4.9	570	210.7
Shenandoah River	(A)	181	(A)	6.4	3054	171.4
Monocacy River		53		3.2	970	153.4
Anacostia River		9		(B)	170	107.8

(A) Waynesboro to Mouth
(B) Water Level Affected by Tide

APPENDIX C

POPULATION*

WASHINGTON METROPOLITAN AREA

Washington, D. C.	797,670
Montgomery County, Md.	163,749
Prince Georges County, Md.	193,799
Alexandria City, Va.	61,604
Arlington County, Va.	134,990
Fairfax County, Va.	98,255
Falls Church City, Va.	7,534

Standard Metropolitan Area

TOTAL: 1,457,601

* U.S. Bureau of the Census, Preliminary Counts, April 1, 1950

APPENDIX D

ESTIMATED POPULATION*

POTOMAC RIVER BASIN

State	Counties	Independent Cities	Metropolitan Counties	Totals
Maryland	226,370		357,548	583,918
Pennsylvania	121,240			121,240
West Virginia	118,420			118,420
Virginia	219,442	125,889	233,245	578,576
Washington, D.C.				797,670
TOTAL IN BASIN - - - - - - - - -				2,199,824

Independent Cities - Virginia	
Alexandria	61,604
Falls Church	7,534
Harrisonburg	10,764
Staunton	19,884
Waynesboro	12,337
Winchester	13,766
TOTAL	125,889

* Based on Census of Population, Preliminary Counts, April 1, 1950

APPENDIX E

POTOMAC RIVER BASIN

POPULATION OF URBAN COMMUNITIES
OF MORE THAN 500

State and Town	Population 1940	Preliminary Count 1950
MARYLAND		
Allens Fresh	1,708	
Barton	781	
Boonsboro	938	1,073
Brunswick	3,856	3,744
Camps Louise and Richie	1,200	
Carlos	515	
Cavetown	2,044	
Clear Spring	500	
Corriganville	500	
Cresaptown	500	
Cumberland	39,483	37,632
Darnestown	1,682	
Detour	500	
Eckhart	1,955	
Ellerslie	1,569	
Emmitsburg	1,412	1,255
Frederick	15,802	18,092
Frostburg	7,659	6,867
Funkstown	1,889	
Gaithersburg	1,021	1,749
Gilmore	662	
Greenbelt	2,831	7,076
Hagerstown	32,491	36,232
Halfway	1,769	
Hancock	940	
Hilltop	800	
Hughesville	500	
Indian Head	1,104	
Keyser Junction	500	
Kitzmiller	870	
Leonardtown	668	1,012
Liberty Town	1,211	
Lonaconing	2,429	2,282
Luke	983	
Marbury	1,552	
Manchester	763	1,024

APPENDIX E

POTOMAC RIVER BASIN

POPULATION OF URBAN COMMUNITIES
OF MORE THAN 500

State and Town	Population 1940	Preliminary Count 1950
MARYLAND (cont.)		
Morgansville	500	
Mechanicsville	1,778	
Middletown	2,051	
Midland	935	
Mount Airy	791	1,062
Mount Savage	3,245	
New Windsor	529	
Potomac Hts.	—	
Rockville	2,047	6,948
Sharpsburg	834	
Smithsburg	619	
Taneytown	1,208	1,422
Thurmont	1,307	1,673
Union Bridge	831	
Union Town	500	
Waldorf	700	
Walkersville	731	
Westernport	3,565	3,441
Westminster	4,692	6,137
Williamsport	1,772	1,886
DISTRICT OF COLUMBIA	663,091	797,670
PENNSYLVANIA		
Blue Ridge	500	
Chambersburg	14,852	17,205
Fayetteville	800	
Gettysburg	5,916	7,043
Greencastle	2,511	2,659
Hyndman	1,325	1,320
Littlestown	2,463	2,634
Marion	600	
Mercersburg	1,763	1,607
McConnellsburg	1,055	1,125
Mont Alto	661	
Rouzerville	950	
Waynesboro	10,231	10,321

APPENDIX E

POTOMAC RIVER BASIN

POPULATION OF URBAN COMMUNITIES

OF MORE THAN 500

State and Town	Population 1940	Preliminary Count 1950
VIRGINIA		
Alexandria	33,523	61,604
Arlington Co.	57,040	134,990
Berryville	1,262	1,393
Bridgewater	993	1,532
Broadway	506	
Colonial Beach	1,105	1,461
Dahlgreen	800	
Dayton	632	
Edinburgh	565	
Elkton	1,050	1,364
Fairfax	979	1,945
Fairfax Co.	40,929	98,255
Falls Church	2,576	7,534
Ft. Belvoir Mil. Res.	—	
Ft. Myer	2,500	
Front Royal	3,831	8,121
Grottoes	759	
Harrisonburg	8,768	10,764
Herndon	1,046	1,471
Leesburg	1,698	1,699
Luray	1,511	2,722
Manassas	1,302	1,789
Middleburg	629	
Millwood	500	
Mt. Jackson	562	
New Market	629	
Quantico	1,139	1,211
Quantico Marine Base	—	
Purcellville	787	
Riverton	500	
Sherandoah	1,829	1,957
Staunton	13,337	19,884
Strasburg	1,968	2,022
Stephens City	600	
Vienna	1,237	2,020

APPENDIX E

POTOMAC RIVER BASIN

POPULATION OF URBAN COMMUNITIES

OF MORE THAN 500

State and Town	Population 1940	Estimated Population 1949
VIRGINIA (cont'd.)'		
Warrentown	1,651	1,784
Waynesboro	7,373	12,337
Winchester	12,095	13,766
Woodstock	1,546	1,786
WEST VIRGINIA		
Bayard	1,145	
Berkeley Springs	585	
Bolivar	628	
Charles Town	2,926	3,030
Franklin	613	
Great Cacapon	525	
Harpers Ferry	665	
Keyser	6,177	6,302
Martinsburg	15,063	15,566
Moorefield	1,291	1,401
Paw Paw	990	
Petersburg	1,751	1,874
Piedmont	2,677	2,564
Ransom	1,171	1,433
Ridgely	1,907	2,262
Romney	2,013	2,053
Shepherdstown	945	1,169
Sugar Grove	500	

APPENDIX F

PRINCIPAL PUBLIC PARK AND RECREATIONAL AREAS

IN THE POTOMAC RIVER BASIN

Name of Area	County	Acreage	Jurisdiction
MARYLAND			
Fort Frederick State Park	Washington	189	Md. Dept. of Forestry
Washington Monument State Park	Washington, Frederick	96	Md. Dept. of Forestry
Cambrill State Park	Frederick	1,041	Md. Dept. of Forestry
Catoctin Recreational Demonstration Area	Frederick	9,888	National Park Service
Antietam National Battlefield	Washington	54	National Park Service
C & O Canal	Montgomery	4,275	National Park Service
Maryland National Capitol Parks	Montgomery, Prince Georges	748	Md. & National Capitol Park and Planning Commission
Cunningham Tract (Pleasant Valley)	Garrett	1,800	Univ. of Maryland
Geo. Washington National Parkway	Montgomery, Pr. Georges	1,277	National Park Service
Fort Tonoloway State Park	Washington	20	Md. Dept. of Forestry
TOTAL		19,324	
Frederick Water Shed	Frederick	6,000	City of Frederick
GRAND TOTAL:		25,324	
PENNSYLVANIA			
Gettysburg National Military Park	Franklin	2,407	
No State Parks except for small developed areas in State Forests.			

APPENDIX F

PRINCIPAL PUBLIC PARK AND RECREATIONAL AREAS

IN THE POTOMAC RIVER BASIN

Name of Area	County	Acreage	Jurisdiction
VIRGINIA			
Manassas National Battlefield Park	Prince William	1,604	
Westmoreland State Park	Westmoreland	1,268	
Chopawamsic Recreational Dam. Area	Prince William	14,080	
Mt. Vernon	Fairfax	394	
George Washington Memorial Parkway	Fairfax, Arlington	1,359	
TOTAL:-		18,705	
WEST VIRGINIA			
Cacapon State Park	Morgan	5,725	
Lost River State Park	Hardy	3,841	
Berkeley Springs State Park	Morgan	7	
TOTAL:-		9,573	
DISTRICT OF COLUMBIA			
National Capital Parks	D.C.	6,500	National Park Service
TOTAL, ALL AREAS:-		62,512	

APPENDIX F

U. S. Government Parks

Gettysburg National Military Park. - This park has been set aside as a national shrine in commemoration of the Battle of Gettysburg and is located just outside of Gettysburg, Pennsylvania.

U.S. Catoctin Recreational Area. - This Area is operated by the State of Maryland and is located in the northwest portion of the State. It is at present (1943) used as an Army training area.

Mount Vernon Memorial Highway. - This comprises the residence of George Washington at Mt. Vernon and the Memorial Parkway between Washington and Mt. Vernon.

C. and O. Canal. - The title of this Canal has been obtained by the National Park Service and it is contemplated to construct a park and parkway to at least Great Falls.

Washington, D.C. Park System

This system comprises the various parks within the District of Columbia, all of which are for the use of the population in Metropolitan Washington.

Maryland

Cambrill State Park, near Frederick

Washington Monument State Park, near Boonsboro.

Fort Frederick State Park, located on the Potomac between Westernport and Hancock.

Pennsylvania

The State of Pennsylvania has included very complete recreational facilities in some of the State Forest areas, the best known of these being Mt. Alto State Forest Park and Caledonia State Forest Park.

APPENDIX F

Virginia

In Virginia, Westmoreland State Park is located below Colonial Beach on the Potomac River.

West Virginia

In West Virginia the Cacapon State Park is located in Morgan County, Southwest of Berkeley Springs. Lost River State Park is located in Hardy County, southeast of Moorefield.

APPENDIX G

WATER RESOURCES

Anacostia River

Source: The Anacostia River is formed by the junction of the northeast and northwest branches, approximately one-half mile north of Bladensburg Road, in the vicinity of Washington.

Course: The River rises 9 miles from the Potomac. The northwest branch begins near Sandy Spring, Maryland, and flows in a southerly direction to the mouth at Bladensburg. The northeast branch is formed by the junction of Paint Branch and Indial Creek, flowing in a southerly direction.

Length: 9 miles to junction with the Potomac.

Fall: A few feet.

Drainage Area: 170 square miles.

Discharge: Northeast Branch at Riverdale, Md.
Drainage Area 72.8 square miles
Max. 3680 s.f. Min. 5.6 s.f.
Northwest Branch near Hyattsville, Md.
Drainage Area 49.4 square miles
Max. 2300 s.f. Min. 0.8 s.f.

Characteristics: The Anacostia River flows in a winding course through marshlands. The river channel is shallow and about 80 to 100 feet wide. Moderate freshets occur and the stream overflows its banks.

Antietam Creek

Source: Antietam Creek proper is the junction of the east and west branches which meet about 1½ miles southwest of Waynesboro, Pennsylvania. The west branch is formed just east of Mont Alto in Quincy township, Franklin County, Pa. The east branch rises 3 miles east of South Mountain Sanatorium, Adams County, Pa.

Antietam Creek (cont.)

Course:	The creek flows southwest from Waynesboro to Hagerstown, then south joining the Potomac 5 miles below Sharpsburg, Maryland.
Length:	39.3 miles
Fall:	6.5 feet per mile
Drainage Area:	292 square miles
Discharge:	Near Sharpsburg, Md. Drainage Area 281 square miles - Max. 6,880 s.f. Min. 35 s.f. Ave. 248 s.f.
Characteristics:	The stream is of the meandering type, flowing through rolling hill country and wide valleys. Much of the land through which it flows is very fertile.

Cacapon River

Source:	The Cacapon River rises in the southeast corner of Hardy County, about 5 miles west of Mathias, West Virginia.
Course:	The river flows northeast across portions of Hardy and Hampshire Counties, then across the [illegible] central portion of Morgan County to the Potomac.
Length:	112 miles
Fall:	12.36 feet per mile
Drainage Area:	682 square miles
Discharge:	Near Great Cacapon, Drainage Area 677 square miles - Max. 87,600 s.f. Min. 35 s.f. Ave. 567 s.f.

Cacapon River (cont.)

Characteristics: The upper two-thirds of the river's course is fairly straight with steep rapids and some small waterfalls. The upper portion of the stream flows mostly through limestone formations. The lower third meanders and flows through a wide valley of shale formations.

The Cacapon River and the Lost River are the same, the name changing where the river goes under Sandy Ridge.

Conococheague Creek

Source: Conococheague Creek rises near South Mountain, Adams County, Pennsylvania.

Course: The creek flows westerly in a winding course to Chambersburg, then southwest to junction with Back Creek at Williamstown, then south by a winding course to the Potomac at Williamsport, Maryland.

Length: 76 miles

Drainage Area: 570 square miles

Fall: From the source to Chambersburg, 34.9 feet per mile; from Chambersburg to mouth, 4.87 feet per mile.

Discharge: At Fairview, Md., Drainage Area 494 square miles Max. 16,300 s.f. Min. 22 s.f. Ave. 559 s.f.

Characteristics: The topography at the headwaters is mountainous and the rest of the area is rolling. The upper regions of the stream pass through shales and sand. In the lower portions of the watershed the rocks are limestone. Most of the tributaries are from the west, only a few coming from the east. The creek channel is generally tortuous in the upper reaches of the Basin. It is bounded by broad valleys. The downstream banks become very high and steep, reaching their maximum in Maryland.

APPENDIX G

Evitts Creek

Source:	Evitts Creek has its source in Cumberland Valley township, near Burning Bush, in southern central Bedford County, Pennsylvania.
Course:	The creek flows southeasterly to the Potomac below Cumberland.
Length:	25 miles
Fall:	30.8 feet per mile
Drainage Area:	94 square miles
Discharge:	Not available. Cumberland City Reservoir located below Gaging Station
Characteristics:	Evitts Creek is located in a mountainous region and it flows largely through mountains and wooded territory. Its valley slopes are generally steep.

Goose Creek

Source:	Near Linden, Virginia
Course:	East to northeast to the Potomac.
Length:	58 miles
Fall:	17.4 feet per mile
Drainage Area:	385 square miles
Discharge:	Near Leesburg, Va., Drainage Area 338 square miles Max. 45,000 s.f. Min. Daily 0.4 s.f. Ave. 293 s.f.
Characteristics:	The stream meanders, rising in the Blue Ridge Mountains and flowing in a winding course through hilly, rolling country to the Potomac about 10 miles above Great Falls.

APPENDIX G

Middle River, Shenandoah

Source:	1/2 mile south of Summerdean, Virginia
Course:	North and northeast to Long Glade, Virginia, then southeast to Verona, then northeast to junction with South Fork of the Shenandoah.
Length:	62 miles
Fall:	14.15 feet per mile
Drainage Area:	363 square miles
Discharge:	Near Grottoes Drainage Area 360 square miles - Max. 24,500 s.f. Min. 22 s.f. Ave. 302 s.f.
Characteristics:	The stream meanders, flowing through rolling hill country.

Monocacy River

Source:	The Monocacy River is formed by the junction of March and Rock Creeks in the vicinity of the south boundary line of Pennsylvania. Marsh Creek rises about 4 miles west of Cashtown, in Adams County, and it flows in a southerly direction. Rock Creek rises about 6 miles north of Gettysburg, flowing south.
Course:	The Monocacy flows southwest in a meandering course to the Potomac, 6 miles below Point of Rocks.
Length:	53 miles
Fall:	Average slope of the Monocacy is 3.2 feet per mile.
Drainage Area:	970 square miles
Discharge:	Near Frederick, Md. Drainage Area 817 square miles Max. 51,000 s.f. Min. 35 s.f. Ave. 910 s.f.

Monocacy River (cont.)

Characteristics: The stream flows through a broad valley of fertile land. Its course is meandering and during rainy periods the stream carries considerable amounts of silt from the surrounding land. Most of the land through which it flows is rich farming territory.

North Branch, Potomac

Source: Fairfax Stone, corner of Tucker, Preston and Grant Counties, West Virginia. Elevation 3,160 feet.

Course: Northeasterly for 45.48 miles to Piedmont. Then it veers sharply southeast for 5.6 miles to Keyser and Cumberland. At Cumberland it turns southeast and continues to junction with South Branch, a distance of 20.8 miles.

Length: 97 miles

Fall: Rate of fall per mile to Piedmont is 50.13 feet. From Piedmont to Keyser and Cumberland it falls 9.70 feet per mile. From Cumberland to junction with the Potomac the rate is 3.37 feet per mile.

Drainage Area: 1328 square miles.

Discharge: Near Cumberland, Drainage Area 875 square miles Max. 68,200 s.f. Min. 12 s.f. Ave. 1203 s.f.

Characteristics: Its valley has high walls and the stream has a moderately swift current with few meanders.

APPENDIX G

North Fork, Shenandoah

Source:	About 6 miles west of Bergton, Virginia
Course:	From Bergton the stream flows southerly, then it turns and flows easterly to Timberville, then northeast, nearly paralleling the course of the South Fork which it joins at Riverton, to form the Shenandoah.
Length:	115 miles
Drainage Area:	1,036 square miles
Discharge:	Near Strasburg, Va., Drainage Area 772 square miles Max. 100,000 s.f. Min. 6 s.f. Ave. 565 s.f.
Characteristics:	All main and tributary streams flow in winding channels. It has a rapid flow which is utilized to some extent for water power.

North River

Source:	On Briery Branch, near West Virginia State Line.
Course:	South, then east to Mt. Solon. Then north to Sangerville, then east and southeast to South Fork of Shenandoah at Port Republic.
Length:	51.6 miles
Fall:	54 feet per mile
Drainage Area:	804 square miles
Discharge:	Near Burketown, Va., Drainage Area 375 square miles Max. 43,000 s.f. Min. 20 s.f. Ave. 380
Characteristics:	The stream rises in mountainous territory and this section flows through narrow, deep valleys. It gradually reaches a low, rolling plain and fertile farm land and in this area the stream meanders until it reaches the South Fork of the Shenandoah.

APPENDIX G

Occoquan Creek

Source:	Cedar Run and Broad Run join to form Occoquan Creek.
Course:	The Creek flows northeast to the junction with Bull Run, then southeast to the Potomac.
Length:	35.0 miles
Fall:	4.92 feet per mile
Drainage Area:	597 square miles to tidal flow.
Discharge:	Near Occoquan, Va., Drainage Area 546 square miles Max. 37,000 s.f. Min. Daily 1.0 s.f. Ave. 468 s.f.
Characteristics:	The creek flows through steep wooded hills and valleys.

Opequon Creek

Source:	The Creek rises just west of Opequon, West Virginia.
Course:	It flows southeast for about 5 miles then northeast to the Potomac.
Length:	59.6 miles
Fall:	11.2 feet per mile
Drainage Area:	335 square miles
Discharge:	Near Berryville, Va., Drainage Area 58 square miles Max. 3630 s.f. Min. Daily 1.9 s.f. (Regulated) Ave. (Unknown) not available.
Characteristics:	The stream flows through fertile, rolling country.

APPENDIX G

Patterson Creek

Source:	Grant County, just south of Lanhamsville, West Virginia
Course:	The Creek flows northeast, parallel to Patterson Creek Mountain
Length:	48.09 miles
Fall:	38.71 feet per mile
Drainage Area:	279 square miles
Discharge:	Near Headsville, W. Va., Drainage Area 216 square miles Max. 16,000 s.f. Min. 3.7 s.f. Ave. -
Characteristics:	This stream is very sluggish, approaching maturity insofar as its geologic life is concerned. The valley is wide and the stream has few tributaries.

Potomac River

Source:	Junction with North and South Branches of the Potomac.
Course:	The main river flows northeast from its junction with the North and South Branches to Hancock, then southeast to Washington. At this point the river turns south and thence southeast to Chesapeake Bay.
Length:	287 miles
Fall:	The slope from the junction of the North and South Branches to Washington is 3.18 feet per mile. There is practically no slope below Washington.
Drainage Area:	14,500 square miles
Discharge:	Near Washington, D.C., Drainage Area 11,560 square miles Max. 484,000 s.f. Min. Daily 448 s.f. Ave. 11,080 s.f.

Potomac River (cont.)

Characteristics:	The lower 117 miles below Washington consist of tidal estuary with low rolling hills on both sides of the river. Above tidewater at Washington the stream is generally shallow with steep slopes. The stream is relatively fast flowing and follows a meandering route from its headwaters to the tidal section.

Rock Creek

Source:	1 mile south of Laytonsville, Montgomery County, Maryland
Course:	South and south-southeast to the District Line, then south to the Potomac River.
Length:	30.3 miles
Fall:	17.5 feet per mile
Drainage Area:	86.0 square miles
Discharge:	Sherril Drive, Washington, D.C., Drainage Area 62.2 square miles. Max. 4,460 s.f. Min. 0.5 s.f. Ave. 52.8 s.f.
Characteristics:	The stream is a meandering one, flowing through wooded valleys and steep to rolling hills.

Savage River

Source:	3 1/2 miles north of Frostburg, Garrett County, Maryland
Course:	Flows in a southwesterly direction in a meandering course, paralleling the mountain ranges of the Allegheny Front. Near Solomon Ridge it turns southeast, joining the North Branch of the Potomac below at Bloomington.

Savage River (cont.)

Length:	25 miles
Fall:	71 feet per mile
Drainage Area:	120 square miles
Discharge:	At Bloomington, Md., Drainage Area 115 square miles Max. 14,800 s.f. Min. 0.7 s.f. Ave. 166 s.f.
Characteristics:	The Savage River rises at the top of the Allegheny Front and flows parallel to these mountain ranges in deep, precipitous valleys to the Potomac River. The current of the stream is very rapid and varies because of the extreme slope of the lands within its Basin.

Shenandoah River

Source:	Junction of the North and South Forks.
Course:	Flows in a northeasterly direction from the west side of and nearly parallel to the Blue Ridge Mountains.
Length:	55 miles (Main Stem)
Fall:	318 feet per mile (Main Stem)
Drainage Area:	3054 square miles (This includes drainage areas for North and South Forks)
Discharge:	Millville, W. Va., Drainage Area 3040 square miles Max. 230,000 s.f. Min. Daily 194 (Regulated) s.f. Ave. 2522 s.f.
Characteristics:	This river is formed by the junction of the North and South Forks of the Shenandoah and flows through a wide, scenic valley which contains fertile farm land. The river flows with a winding channel and the current is rather rapid. On each side of the valley are mountain ranges of considerable height.

APPENDIX G

South Branch, Potomac

Source:	Near Monterey, Highland County, Virginia
Course:	Northeasterly across Pendleton, Grant, Hardy and Hampshire Counties, West Virginia, joining the North Branch below Oldtown, Md. forming the main Potomac
Length:	133 miles
Fall:	From source to Hardy County Line, 42.91 feet per mile. From there to mouth 5.23 feet per mile.
Drainage Area:	1488 square miles
Discharge:	Near Springfield, W. Va., Drainage Area 1471 square miles Max. 143,000 s.f. Min. 50 s.f. Ave. 1245 s.f.
Characteristics:	The upper reaches of the river are swift and flow through rugged, narrow valleys. The lower portion goes through considerably wider valleys which are of agricultural value.

South Fork, Shenandoah

Source:	Southeast of Greenville, Augusta County, Virginia
Course:	Flows in a northeasterly direction approximately parallel to the mountain ranges to its junction with the North Fork joining Shenandoah River at Riverton
Length:	136 miles
Drainage Area:	1653 square miles
Discharge:	At Front Royal, Va., Drainage Area 1638 square miles Max. 130,000 s.f. Min. 59 s.f. Ave. 1687 s.f.
Characteristics:	This river flows through mountainous country in a valley which varies from a few miles wide to as much as 40 miles wide. The stream takes a winding course and has a rapid current.

APPENDIX G

Wicomico River

Source:	Just northeast of Cedarville, Prince Georges County, Maryland
Course:	Flows in a southerly direction through Zekiah Swamp, then easterly and southerly to the Potomac.
Length:	37 miles
Fall:	From mouth to Allens Fresh, a distance of 15 miles, there is no slope. From Allens Fresh to Cedarville the slope is 10 feet per mile.
Drainage Area:	247 square miles.
Characteristics:	The topography at the headwaters is characterized by rolling hills. The stream descends rapidly through these hills to Zekiah Swamp, going through the Swamp for about 12 miles, then it becomes a tidewater stream to its mouth. The stream is more or less tidal for most of its length, flowing through swamplands.

Wills Creek

Source:	Larimer Township, in southeastern Somerset County, Pennsylvania.
Course:	Northwesterly and easterly from Bedford County to Hyndman, then south to Maryland and the Potomac River, joining the Potomac at Cumberland.
Length:	30 miles
Fall:	58.5 feet per mile
Drainage Area:	257 square miles
Discharge:	Near Cumberland, Md. Drainage Area 247 square miles Max. 38,100 s.f. Min. 9 s.f. Ave. 311 s.f.
Characteristics:	The slope of the stream bed is steep, causing moderately swift currents. The stream flows through a steep and mountainous section with rock outcropping in many places.

APPENDIX B

SUMMARY OF SURFACE WATER SUPPLIES IN THE POTOMAC RIVER BASIN
(Municipal and Industrial

Key: C - Chlorination
F - Filtration
S - Screens
s - Sawdust and Excelsoir Filters
pH - pH Adjustment

Municipality or Plant	Source	Type of Treatment	Estimated Water Consumption, Gallons Per Day, 1948	Population Served
Hagerstown, Md.	Potomac River	F-C pH	4,500,000	36,600
Hancock, Md.	" "	F-C	150,000	940
Indian Head, Power Plant, Md.	" "	C-6 mos. yr.	12,960,000	
Luke, Md. (Use Savage River as Auxiliary Supply)	" "	F-C pH	175,000	990
Williamsport, Md.				
W. D. Byron & Sons	" "	None	200,000	
Potomac Edison Co.	" "	None	124,000,000	

APPENDIX H

SUMMARY OF SURFACE WATER SUPPLIES IN THE POTOMAC RIVER BASIN
(Municipal and Industrial)

Municipality or Plant	Source	Type of Treatment	Estimated Water Consumption, Gallons Per Day, 1948	Population Served
Alexandria, Va.				
Virginia Public Service	Potomac River	F-C	7,500,000	-
Potomac Electric Power Co.	" "		100,000,000*	-
Green Spring, W. Va.				
B & O Tie Plant	" "	Lime, ash Sedimentation	150,000	
Paw Paw, W. Va.				
Keystone Tanning Co. (Paw Paw Tannery)	Potomac River	None	200,000	
Shepherdstown, W. Va.	" "	F-C	40,000	945
Washington, D.C. (Also serves Arlington Co., Falls Church and part of Fairfax Co., Va.)	" "	F-C pH	164,000,000 (Av.) 220,000,000 (Max.)	1,035,000

* Water consumption will increase to 192,672,000 gallons per day when second generating unit goes into operation on June 15, 1950

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APPENDIX H

SUMMARY OF SURFACE WATER SUPPLIES IN THE POTOMAC RIVER BASIN
(Municipal and Industrial)

Municipality or Plant	Source	Type of Treatment	Estimated Water Consumption, Gallons per Day, 1948	Population Served
Washington, D.C.				
Potomac Electric Power Co.- Buzzard Point Station	Potomac River	-	448,160,000 (Summer) 300,672,000 (Winter)	
TOTAL . . (Potomac River) . . .			913,035,000	1,074,475
Cumberland, Md.	No. Br. Potomac River	F-C	7,000,000	44,110
Potomac Edison Co.	"	None	74,300,000	
Celanese Corporation	"	F-s	40,000,000	
Kelly-Springfield Tire Co.	"	None	20,000,000	
Kempton, Md.				
Davis Coal & Coke Co.	"	-	125,000	
Luke, Md.				
W. Va. Pulp & Paper Co.	"	F-C	11,000,000	
TOTAL . . (No. Branch Potomac River). . .			152,925,000	44,110

APPENDIX H

SUMMARY OF SURFACE WATER SUPPLIES IN THE POTOMAC RIVER BASIN
(Municipal and Industrial)

Municipality or Plant	Source	Type of Treatment	Estimated Water Consumption, Gallons Per Day, 1948	Population Served
Petersburg, W. Va. Keystone Tanning & Glue Co.	So. Br. Potomac R.	-	75,000	
Romney, W. Va.	"	F-C	150,000	2,015
Romney, W. Va. School for Deaf & Blind	"	F-C	40,000	400
	TOTAL . . .(So. Br. Potomac R.). . .		275,000	2,415
Front Royal, Va. American Viscose Corp.	S. Fk. Shenandoah R.	F-s in part	1,200,000	
Shenandoah, Va. Norfolk & Western	"	F-C	1,000,000	300
Shenandoah, Va.	"	F-C	180,000	1,625
	TOTAL . . .(S. Fk. Shenandoah River). .		2,380,000	1,925

APPENDIX H

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(Municipal and Industrial)

Municipality or Plant	Source	Type of Treatment	Estimated Water Consumption, Gallons Per Day, 1948	Population Served
Broadway, Va.	N. Fk. Shenandoah River	F-C	40,000	400
Timberville, Va.				
Food Processors Water Cooperative	"	F-C	500,000	
TOTAL . . .(No. Fk. Shenandoah R.).			540,000	400
Hagerstown, Md.				
Municipal Electric Light Plant	Antietam Creek	None	7,200,000	
Security Md.				
No. Am. Cement Corp.	"	None	20,160,000	
Potomac Edison Co.	"	None	59,600,000	
TOTAL . . .(Antietam Creek). . .			86,960,000	

APPENDIX H

SUMMARY OF SURFACE WATER SUPPLIES IN THE POTOMAC RIVER BASIN
(Municipal and Industrial)

Municipality or Plant	Source	Type of Treatment	Estimated Water Consumption, Gallons Per Day, 1948	Population Served
Westernport, Md.	Savage River	C	450,000	3,800
Piedmont, W. Va.	"	F-C	619,000	2,675
	TOTAL . . . (Savage River). .		1,069,000	6,475
Emmitsburg, Md.	Turkey Branch Creek (Auxiliary Supply)	C	100,000	1,470
Frederick, Md.	Linganore Creek	F-C pH	1,500,000	17,150
Frostburg, Md.	Piney Run	F-C pH	400,000	5,140
Lonaconing, Md.	Jackson & Koontz Runs	C	200,000	2,730
Midland, Md.	Elklick Run	C	50,000	

APPENDIX H

SUMMARY OF SURFACE WATER SUPPLIES IN THE POTOMAC RIVER BASIN
(Municipal and Industrial)

Municipality or Plant	Source	Type of Treatment	Estimated Water Consumption, Gallons per Day, 1980	Population Served
State TB Sanatorium, Md.	Owens Creek	C	88,000	600
Thurmont, Md.	High Run	C	100,000	
W.S.S.D. Burnt Mills Plant, Md.	NW Br. Anacostia & Patuxent Rivers	F-C pH	4,000,000	
Chambersburg, Pa. Chambersburg Light Co.	Falling Spring	-	2,500,000	
Chambersburg, Pa.	Birch Creek, Hoosic Run	C	3,300,000	15,500
Gettysburg, Pa.	Marsh Creek	F-C	500,000	5,920
Hyndman, Pa.	Laurel Run	N	80,000	1,325
Mercersburg, Pa.	Buck Run	C	200,000	1,800

APPENDIX H

SUMMARY OF SURFACE WATER SUPPLIES IN THE POTOMAC RIVER BASIN
(Municipal and Industrial)

Municipality or Plant	Source	Type of Treatment	Estimated Water Consumption, Gallons Per Day, 1948	Population Served
Mont Alto State Sanatorium, Pennsylvania	W. Br. Antietam Creek	C	250,000	1,200
Waynesboro, Pa.	Rattlesnake & Bailey Runs	C	2,950,000	11,000
Alexandria, Va.*	Holmes & Cameron Runs	F-C	6,000,000	72,000
Berryville, Va.	Surface Supply	C	80,000	1,500
D. C. Workhouse & Reformatory, Va.	Surface Supply	F-C	1,250,000	3,000
Fort Belvoir, Va.	Accotink Creek	F-C	2,000,000	8,000

*(Alexandria, Va.) - New supply from Occoquan Creek is under construction. Treatment plant of 8.75 mgd. capacity. Present supply will be abandoned.

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APPENDIX H

SUMMARY OF SURFACE WATER SUPPLIES IN THE POTOMAC RIVER BASIN
(Municipal and Industrial)

Municipality or Plant	Source	Type of Treatment	Estimated Water Consumption, Gallons per Day, 1948	Population Served
Front Royal, Va.*	Happy & Harmony Hollow Creeks	F-C	1,000,000	8,000
Grottoes, Va. Duplan Silk Mill	Creek	-	1,440,000	
Harrisonburg, Va.	Surface Supply	C	1,500,000	10,000
Luray, Va. Va. Oak Tannery	Hawkshill Creek	-	150,000	
Luray, Va.	Marys Rock & Stony Man Creeks	C	250,000	2,000
Middleburg, Va.	Surface Supply	F-C	50,000	500
Millville, Va. Standard Lime & Stone Co.	Shenandoah River	None	5,760,000	

*(Front Royal, Va.) - Auxiliary supply from South Fork Shenandoah River. Treatment by filtration plant listed.

APPENDIX H

SUMMARY OF SURFACE WATER SUPPLIES IN THE POTOMAC RIVER BASIN
(Municipal and Industrial)

Municipality or Plant	Source	Type of Treatment	Estimated Water Consumption, Gallons Per Day, 1948	Population Served
New Market, Va.*	Surface Supply	C	65,000	700
Purcellville, Va.	No. Br. Catoctin Creek	C	50,000	800
Quantico & Marine Base, Va.	Chopawamsic Creek	F-C	2,000,000	-
Round Hill, Va.	Surface Supply	C	20,000	300
Staunton, Va.	Surface Supply	C	2,000,000	18,000
Strasburg, Va.*	Creek	C	140,000	2,000
Warrenton, Va.	Cedar Run	F-C	100,000	2,700

*(New Market, Va.) - Auxiliary supply from Smith Creek - Treatment by conventional water filtration plant.

*(Strasburg, Va.) - Auxiliary supply from North Fork Shenandoah River. Treatment by conventional water filtration plant.

APPENDIX H

SUMMARY OF SURFACE WATER SUPPLIES IN THE POTOMAC RIVER BASIN
(Municipal and Industrial)

Municipality or Plant	Source	Type of Treatment	Estimated Water Consumption, Gallons Per Day, 1948	Population Served
Waynesboro, Va.				
Crompton-Shenandoah Co.	Bakers Spring	Softening	1,500,000	
DuPont Rayon Co.	South River	Demineralized	500,000	
Winchester, Va.				
O'Sullivan Rubber Co.	Abrams Creek	-	440,000	
Woodstock, Va.	Stony Creek	C	100,000	2,500
Blairton, W. Va.				
Blair Limestone Co.	Opequon Creek	-	2,000,000	
Halltown, W. Va.				
Halltown Paper Board Plant	Flowing Spring Run	None	1,375,000	
Keyser, W. Va.	Run	C	2,000,000	6,000
Martinsburg, W. Va.				
National Fruit Prod. Co.	Tuscarora Creek	-	900,000	

APPENDIX H

SUMMARY OF SURFACE WATER SUPPLIES IN THE POTOMAC RIVER BASIN
(Municipal and Industrial)

Municipality or Plant	Source	Type of Treatment	Estimated Water Consumption, Gallons per Day, 1948	Population Served
Middleway, W. Va.				
Virginia Woolen Co.	Turkey Run	-	650,000	
Moorefield, W. Va.				
Keystone Tanning & Glue Co.	So. Fk. of S. Branch Potomac River	-	75,000	
District of Columbia				
Potomac Electric Power Co.	Anacostia River	-	195,810,000 (Summer)	
Benning Station			166,830,000 (Winter)	
11 Small Sources	Various	-	197,500	
	TOTAL . . . (Miscellaneous) . . .		245,620,500	193,835
	GRAND TOTAL		1,407,804,500	1,323,635

APPENDIX I

Municipal and Institutional Sewage Treatment Plants Showing Date of Construction and Design Population - Listed in Order of Dates of Construction

(Data from Census of Water and Sewerage Works, U.S.P.H.S., 1949)

Name of Community or Institution	Date Completed	Design Population
MARYLAND		
W.S.S.D - Gaithersburg Plant	1927	2,500
St. Josephs Academy - Emmitsburg	1928	900
St. Mary's College - Emmitsburg	1929	700
Sanatorium, State T.B. Sanatorium	1931	1,000
Maryland State Reformatory for Males, Roxbury	1932	500
Hagerstown	1933	40,000
Williamsport (3 plants)	1934	2,000
Beltsville - Research Center	1935	4,000
Westminster	1935	5,000
Emmitsburg	1936	1,200
Glen Dale T.B. Sanatorium	1936	1,000
Greenbelt	1937	3,100
Frederick	1938	15,000
Indian Head	1938	1,000
W.S.S.D. - Newton Village Plant	1938	250
Leonardtown	1939	1,000
Myersville	1939	500
Rockville	1939	3,000
Henrytown, Md. - T.B. Sanatorium	1939	700
Thurmont	1940	1,500
W.S.S.D. Anacostia Plant	1940	45,000*
W.S.S.D. Woodmoor Plant	1940	1,000
Beltsville, U.S. Horticultural Station	1940	600
Glymont - U.S. Housing Project	1941	2,600
W.S.S.D. Cedarock Housing Project	1942	500
Cedarock Housing Project	1942	100
Total		134,650

* Estimated Population Served

APPENDIX I

Municipal and Institutional Sewage Treatment Plants Showing Date of Construction and Design Population - Listed in Order of Dates of Construction

(Data from Census of Water and Sewerage Works, U.S.P.H.S., 1949)

Name of Community or Institution	Date Completed	Design Population
VIRGINIA		
Colonial Beach	1913	2,500*
Manassas	1914	500
Harrisonburg	1916	8,600
Front Royal	1920	1,000
Lorton, D.C. Reformatory	1932	2,200*
Middleburg - Foxcroft School	1933	200*
Skyland	1936	200*
Fairfax	1937	750
Arlington County	1937	50,000
Perryville	1937	1,000
Herndon	1937	1,000
Orkney Springs	1937	300*
Middleburg, (Taguipin Run)	1938	750
Middleburg, (Trib. to Goose Creek)	1938	250
Staunton	1939	20,000
Leesburg	1939	2,000
Lorton, D.C. - Workhouse	1940	1,200*
Greenway - Maderia School	1942	200
Midway Island - Federal Housing Project	1942	1,000
Regional High School Prince William County	1942	450*
Valley Housing Corp. - Timberville	1945	400
Linton Hall - Prince William County	1946	300
Fairfax County - Hollin Hall Subdivision	1948	1,000
Purcellville	1948	1,200
Triangle Apartments	1948	160
Winchester	1949	31,000
Front Royal	Under Constr.	12,000
Manassas	"	3,100
Rockingham County Massanetta Springs	"	1,200
Vienna	"	2,000
	TOTAL:-	146,460

* Estimated Population Served

APPENDIX I

Municipal and Institutional Sewage Treatment Plants Showing Date of Construction and Design Population - Listed in Order of Dates of Construction

(Data from Census of Water and Sewerage Works, U.S.P.H.S., 1949)

Name of Community or Institution	Date Completed	Design Population
PENNSYLVANIA		
Chambersburg	1939	15,000
Gettysburg	1926	7,500
Mt. Alto Sanatorium	1939	2,000
Littletown	1944	3,200
Scotland	1942	600
Waynesboro	1937	10,500
	TOTAL:-	38,800

WATER QUALITY SAMPLING STATIONS IN THE POTOMAC RIVER DRAINAGE BASIN

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN
WASHINGTON, D.C.
SEPT. 16, 1949

J-5

LEGEND
Dissolved Oxygen prevailing for worst ½ of the time.
Greater than 7.5 p.p.m.
6.5 to 7.5 p.p.m.
5.0 to 6.4 p.p.m.
3.0 to 4.9 p.p.m.
Less than 3.0 p.p.m.
PENNSYLVANIA
MARYLAND
VIRGINIA
WEST VIRGINIA
HYNDMAN
CHAMBERSBURG
WAYNESBORO
GETTYSBURG
HAGERSTOWN
EMMITSBURG
WILLIAMSPORT
MARTINSBURG
MIDDLETOWN
FREDERICK
BRUNSWICK
ROMNEY
KEYSER
CHARLES TOWN
WINCHESTER
LEESBURG
FRONT ROYAL
MIDDLEBURG
WOODSTOCK
MT. JACKSON
NEW MARKET
HARRISONBURG
SHENANDOAH
STAUNTON
WAYNESBORO
MANASSAS
WARRENTON
QUANTICO
LA PLATA
INDIAN HEAD
FT. BELVOIR
ALEXANDRIA
FAIRFAX
LORTON
POTOMAC RIVER
SCALE IN MILES
10 0 10 20 30
DISSOLVED OXYGEN
AT THE
WATER QUALITY SAMPLING STATIONS
IN THE
POTOMAC RIVER DRAINAGE BASIN

BIOCHEMICAL OXYGEN DEMAND AT THE WATER QUALITY SAMPLING STATIONS IN THE POTOMAC RIVER DRAINAGE BASIN